FIG. 1A

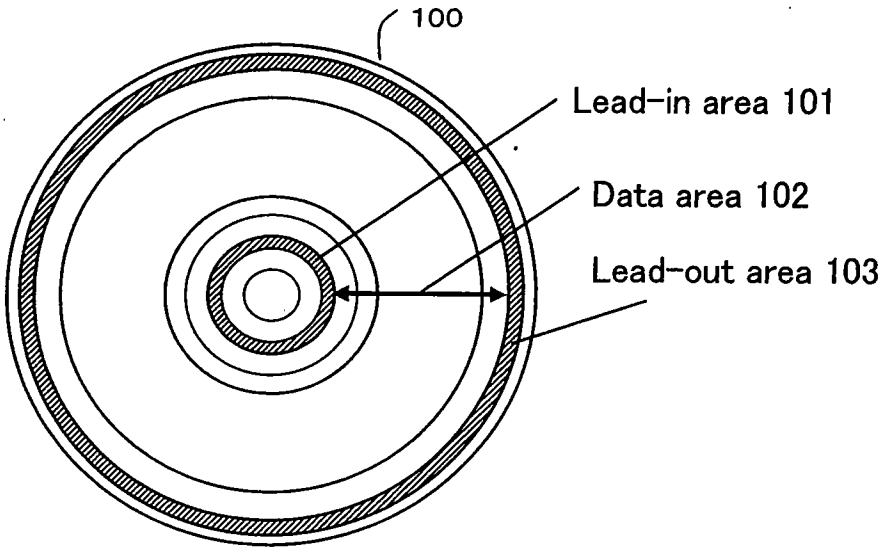


FIG. 1B

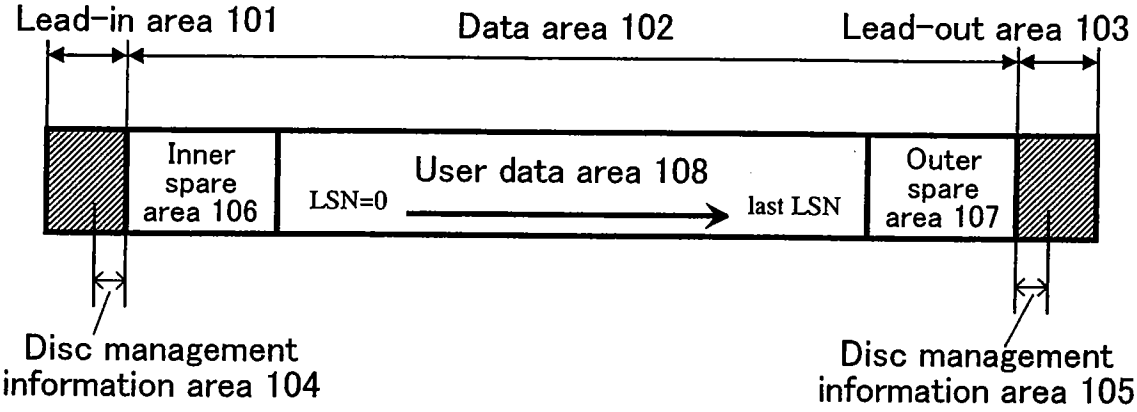


FIG. 1C

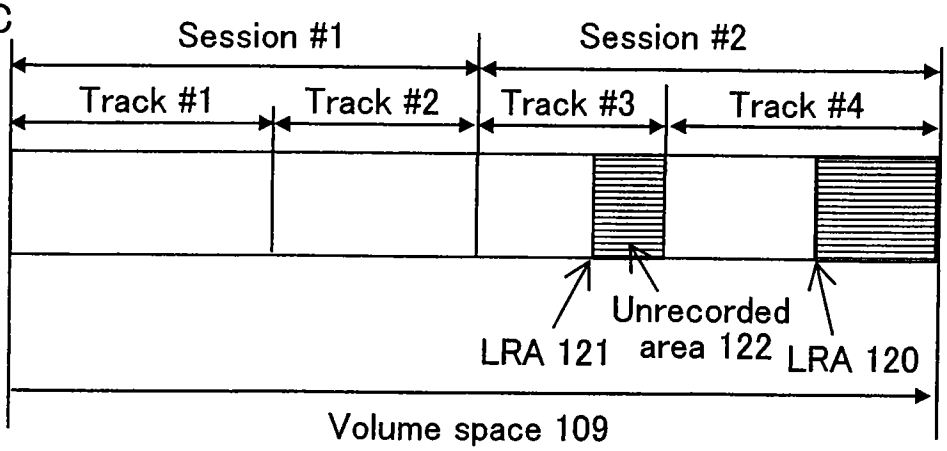


FIG. 2A

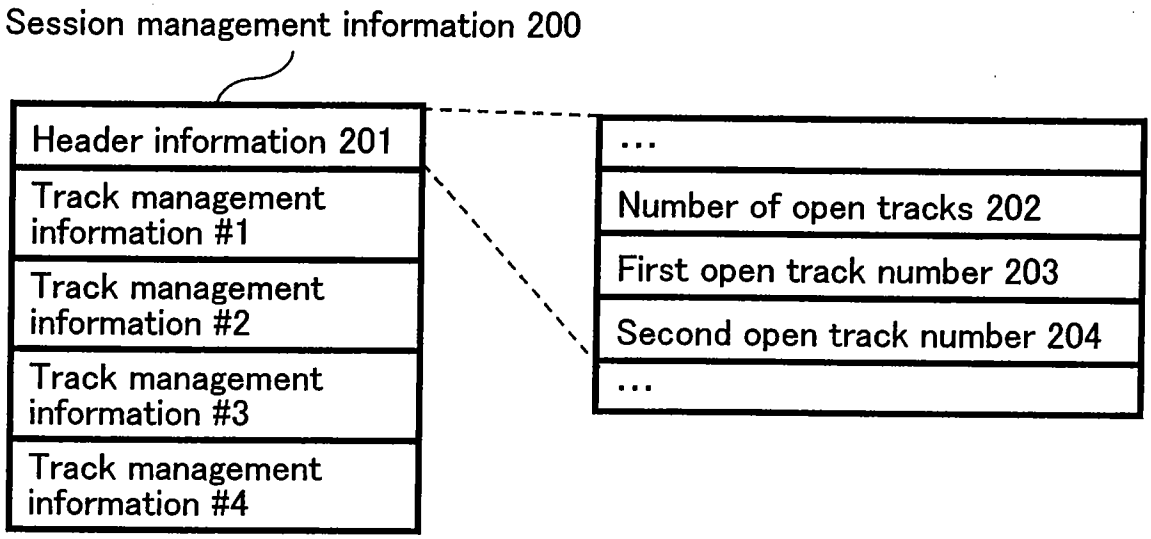


FIG. 2B

Track management information 210

Session start information 211	Track start location information 212	Last recorded address information within track (LRA) 213

FIG. 2C

Space bitmap management information 220

Header information 221
Managed area information 222
Space bitmap information 223

FIG.3

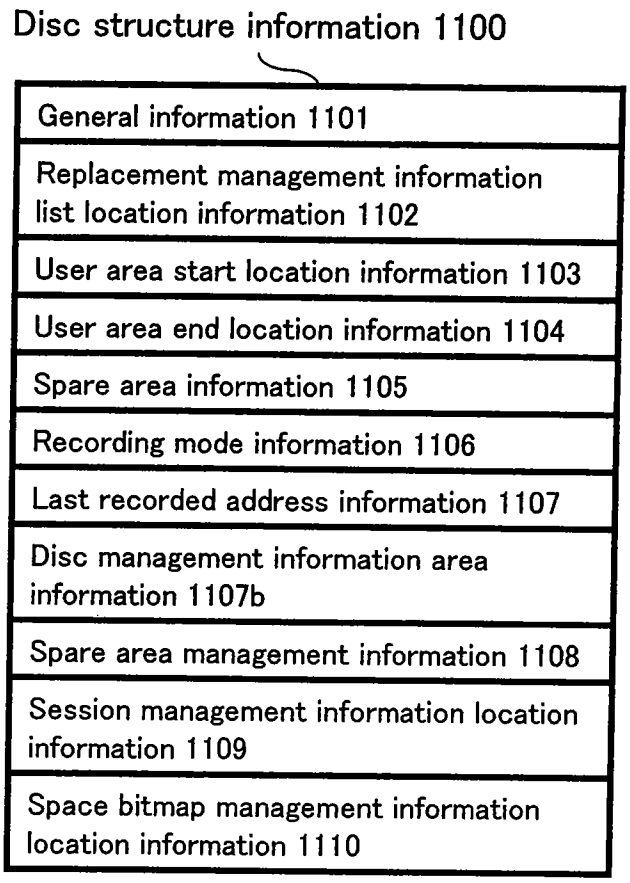

Disc structure information 1100
General information 1101
Replacement management information list location information 1102
User area start location information 1103
User area end location information 1104
Spare area information 1105
Recording mode information 1106
Last recorded address information 1107
Disc management information area information 1107b
Spare area management information 1108
Session management information location information 1109
Space bitmap management information location information 1110

FIG.4

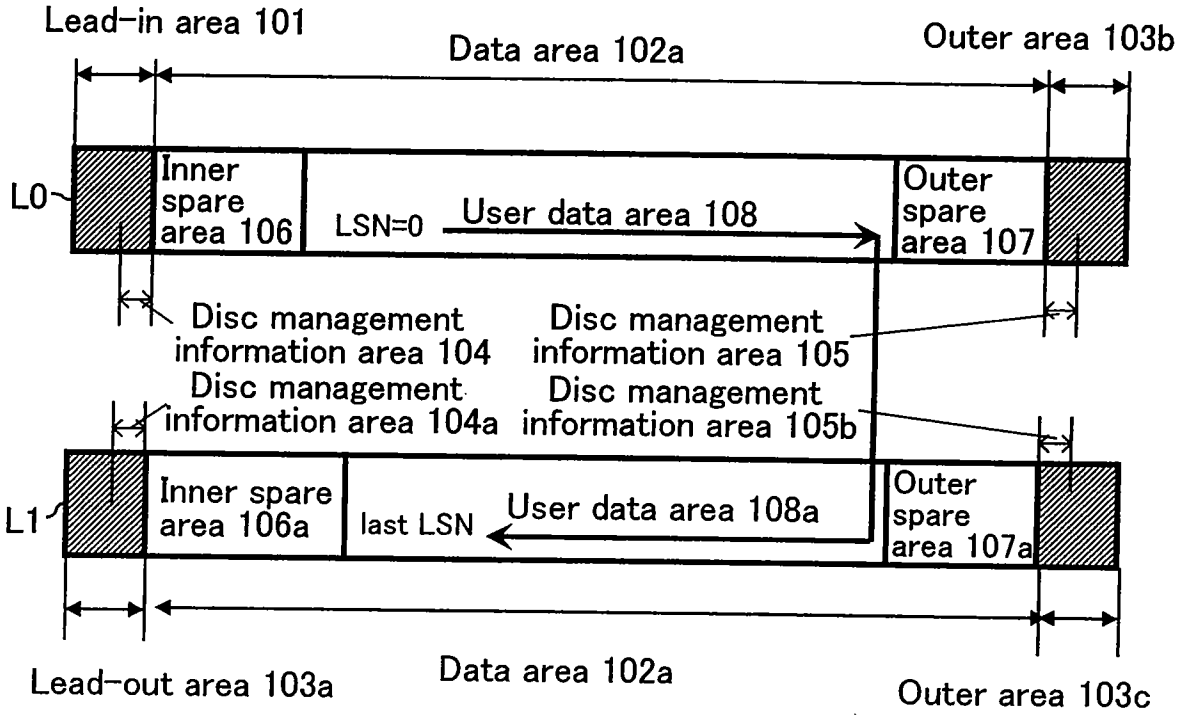

100b
Lead-in area 101
Data area 102a
Outer area 103b
L0
Inner spare area 106
LSN=0
User data area 108
Outer spare area 107
Disc management information area 104
Disc management information area 105
Disc management information area 104a
Disc management information area 105b
L1
Inner spare area 106a
last LSN
User data area 108a
Outer spare area 107a
Lead-out area 103a
Data area 102a
Outer area 103c

FIG.5A

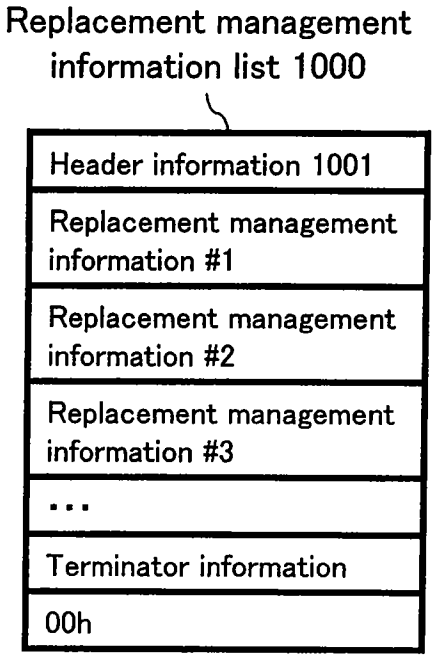

Replacement management information list 1000
Header information 1001
Replacement management information #1
Replacement management information #2
Replacement management information #3
...
Terminator information
00h

FIG.5B

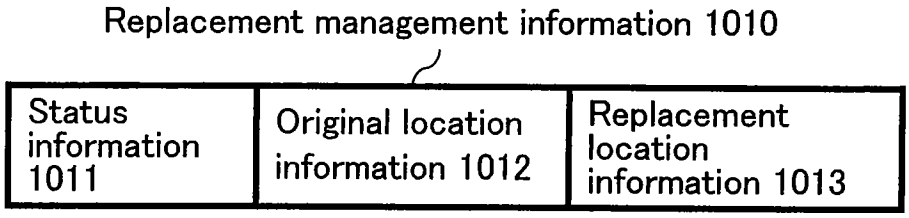

Replacement management information 1010
Status information 1011
Original location information 1012
Replacement location information 1013

FIG.6

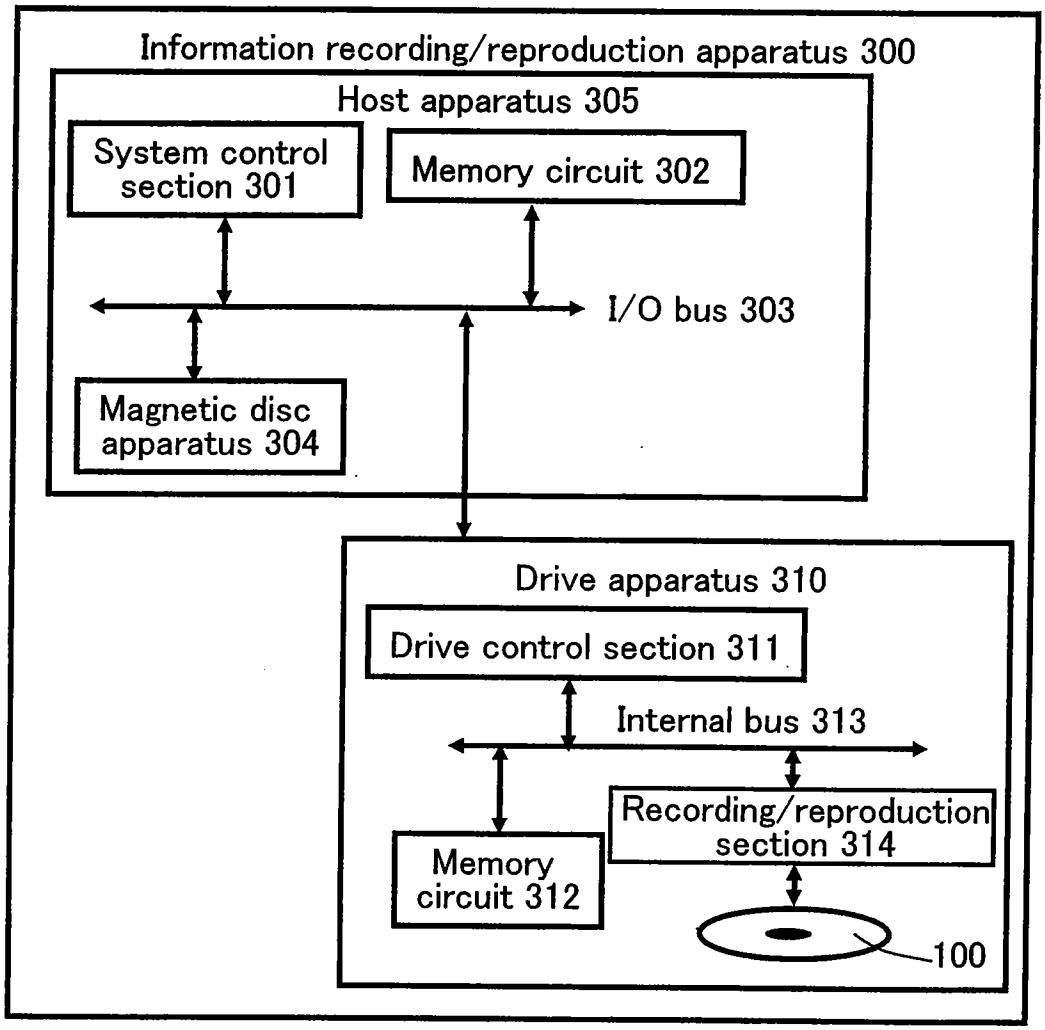

Information recording/reproduction apparatus 300
Host apparatus 305
System control section 301
Memory circuit 302
I/O bus 303
Magnetic disc apparatus 304
Drive apparatus 310
Drive control section 311
Internal bus 313
Recording/reproduction section 314
Memory circuit 312
100

FIG.7

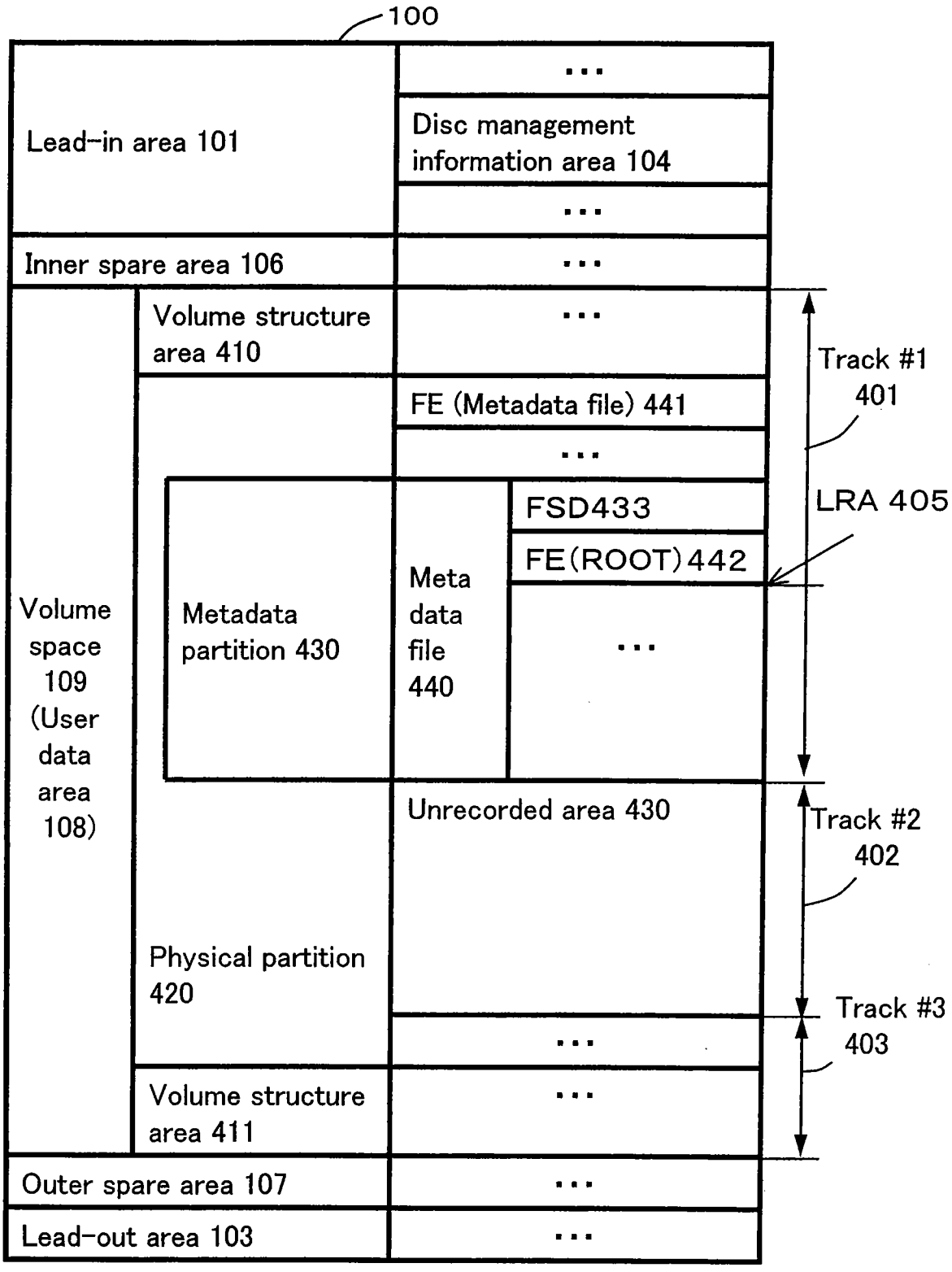

100
Lead-in area 101
Disc management information area 104
Inner spare area 106
Volume structure area 410
FE (Metadata file) 441
FSD433
FE(ROOT)442
Volume space 109 (User data area 108)
Metadata partition 430
Meta data file 440
Unrecorded area 430
Physical partition 420
Volume structure area 411
Outer spare area 107
Lead-out area 103
Track #1 401
LRA 405
Track #2 402
Track #3 403

FIG.8A

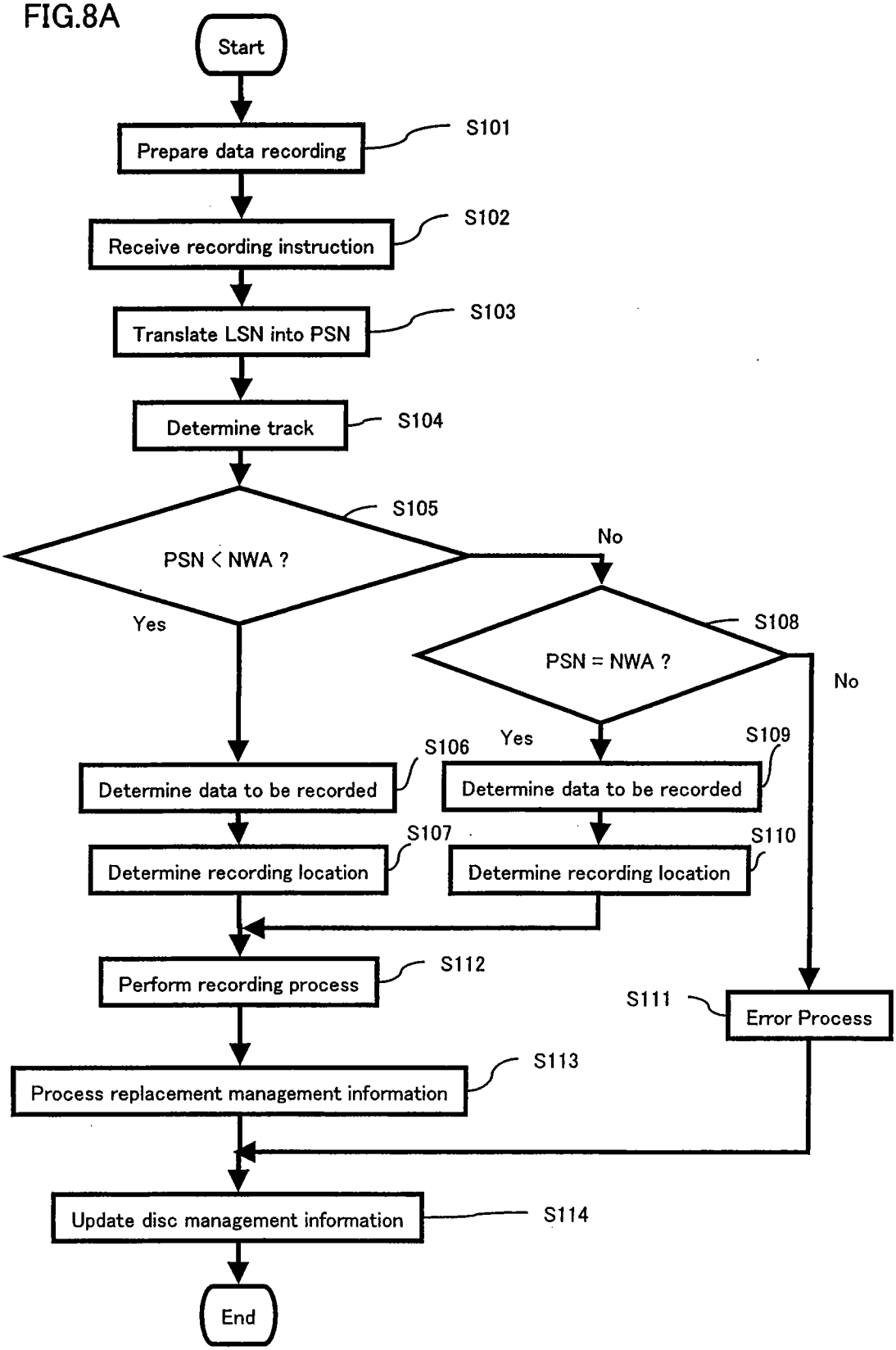

Start
Prepare data recording
S101
Receive recording instruction
S102
Translate LSN into PSN
S103
Determine track
S104
S105
PSN < NWA ?
No
Yes
S108
PSN = NWA ?
No
Yes
S106
S109
Determine data to be recorded
Determine data to be recorded
S107
S110
Determine recording location
Determine recording location
S112
Perform recording process
S111
Error Process
S113
Process replacement management information
Update disc management information
S114
End

FIG.8B

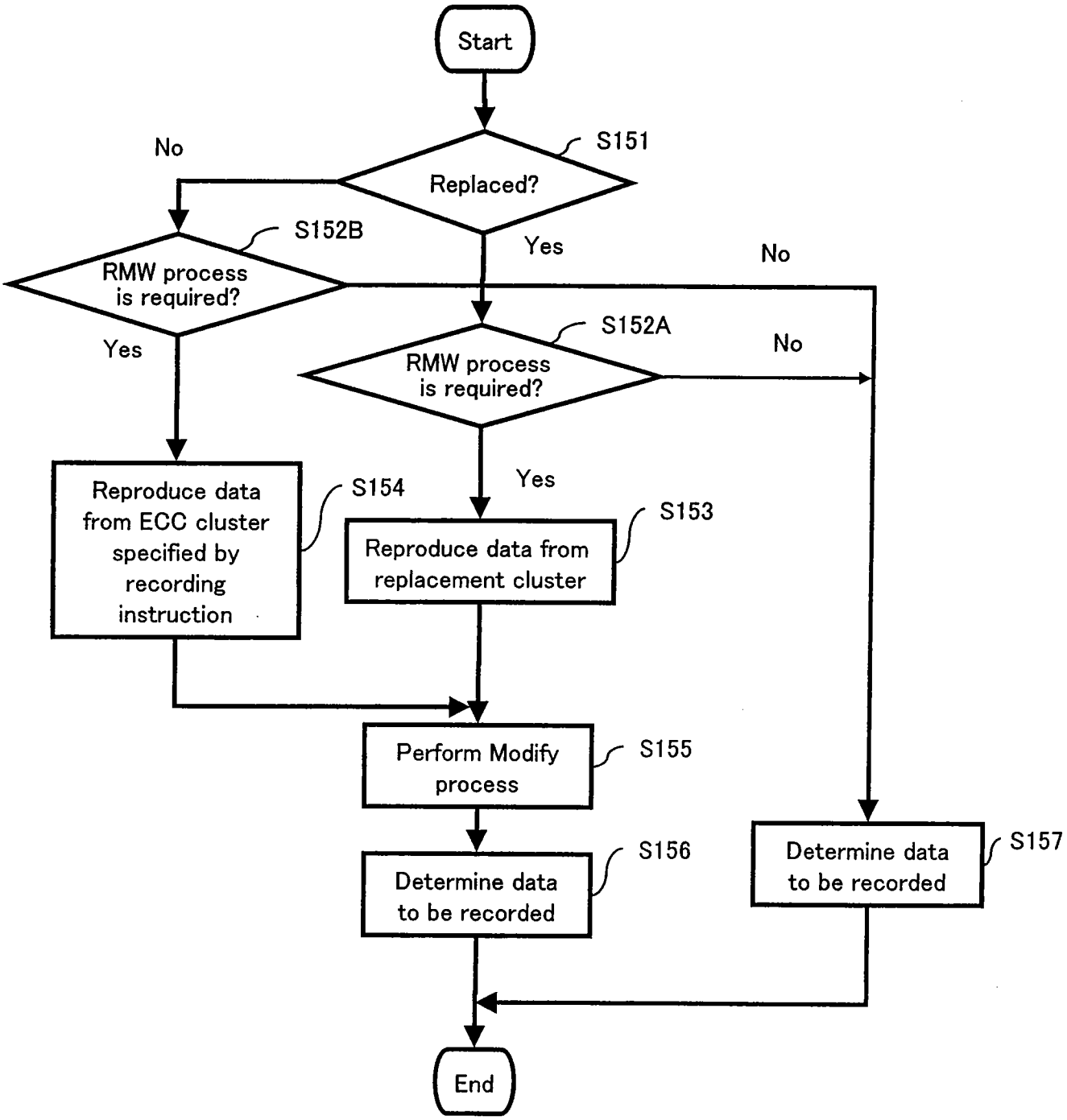

Start
S151
Replaced?
No
Yes
S152B
RMW process is required?
Yes
No
S152A
RMW process is required?
No
Yes
Reproduce data from ECC cluster specified by recording instruction
S154
Reproduce data from replacement cluster
S153
Perform Modify process
S155
Determine data to be recorded
S156
Determine data to be recorded
S157
End

FIG.9

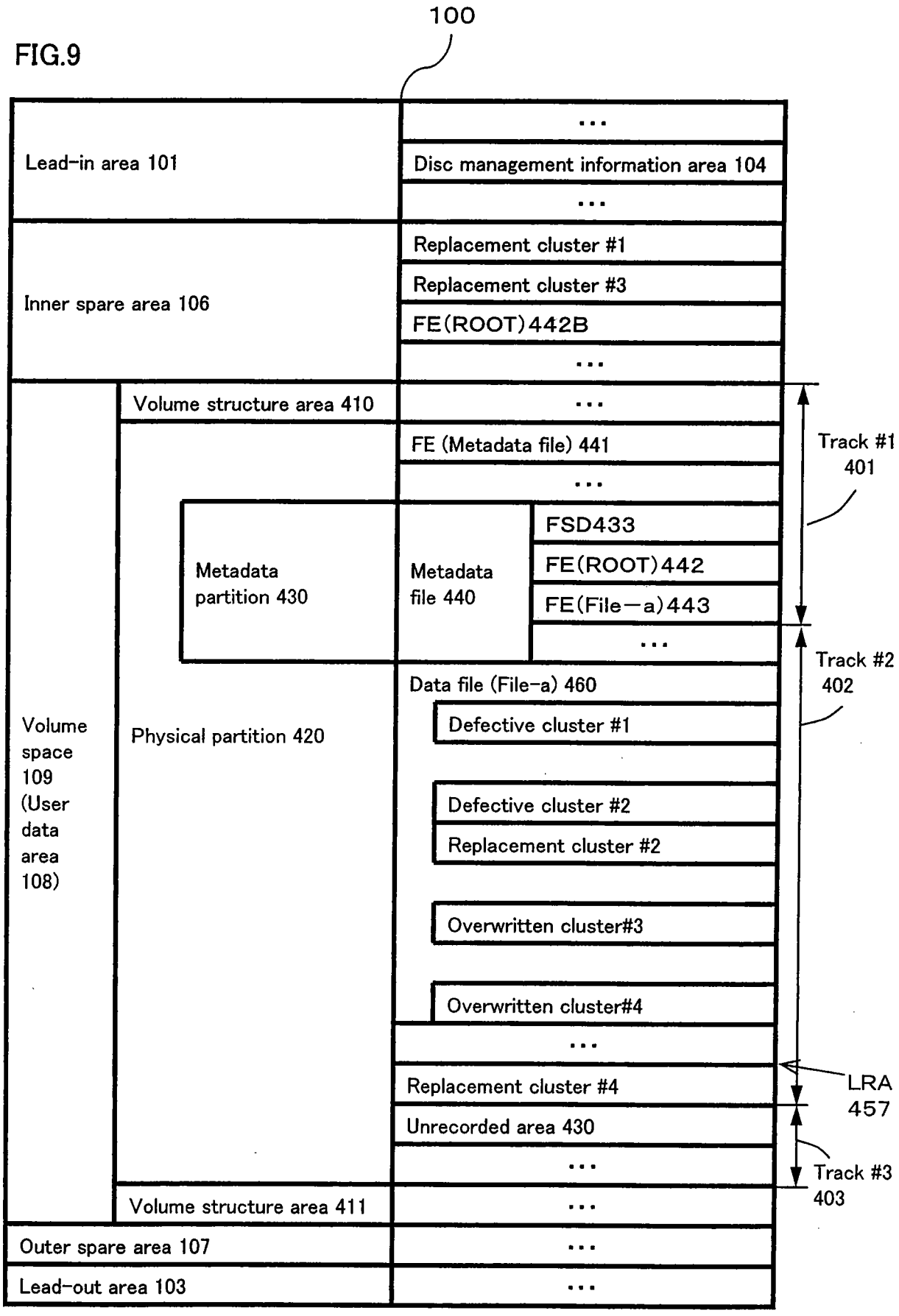

100
Lead-in area 101
Disc management information area 104
Inner spare area 106
Replacement cluster #1
Replacement cluster #3
FE(ROOT)442B
Volume structure area 410
FE (Metadata file) 441
Metadata partition 430
Metadata file 440
FSD433
FE(ROOT)442
FE(File−a)443
Track #1 401
Track #2 402
Data file (File-a) 460
Defective cluster #1
Defective cluster #2
Replacement cluster #2
Overwritten cluster#3
Overwritten cluster#4
Volume space 109 (User data area 108)
Physical partition 420
Replacement cluster #4
LRA 457
Unrecorded area 430
Track #3 403
Volume structure area 411
Outer spare area 107
Lead-out area 103

FIG.10

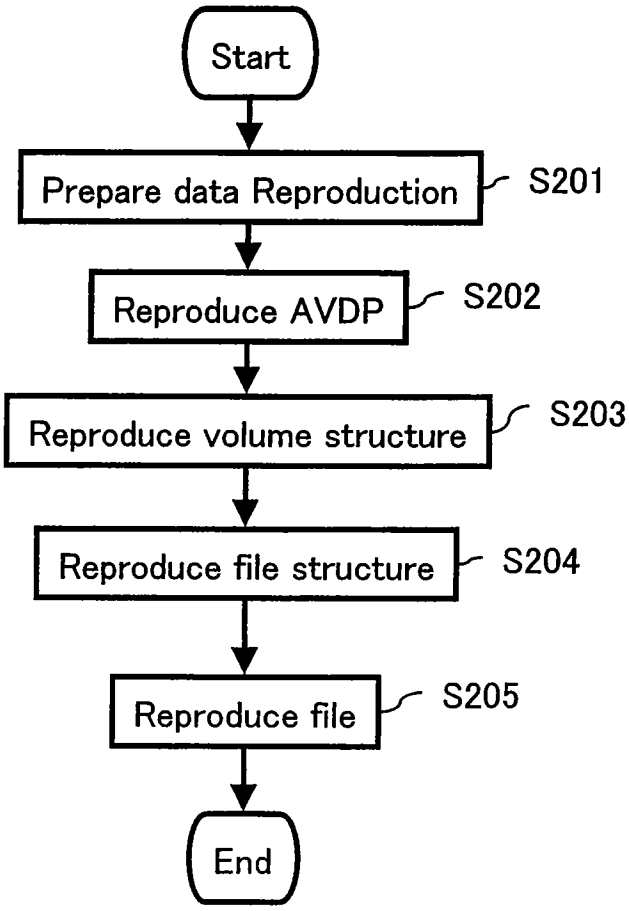

Start
Prepare data Reproduction
S201
Reproduce AVDP
S202
Reproduce volume structure
S203
Reproduce file structure
S204
Reproduce file
S205
End

FIG.11

Replacement management information 1010B

Status information 1011			Original location information 1012	Replacement location information 1013	Type
Flag1	Flag2	Flag3			
0	0	00	Defective cluster or Overwritten cluster location information	Replacement cluster location information (in Spare area)	(1)
0	0	01	Defective clusters or Overwritten clusters start location information	Replacement cluster start location information (in Spare area)	(2)
0	0	10	Defective clusters or Overwritten clusters end location information	Replacement cluster end location information (in Spare area)	(3)
0	1	00	Defective cluster or Overwritten cluster location information	Replacement cluster location information (in User data area)	(4)
0	1	01	Defective clusters or Overwritten clusters start location information	Replacement cluster start location information (in User data area)	(5)
0	1	10	Defective clusters or Overwritten clusters end location information	Replacement cluster end location information (in User data area)	(6)
1	0	00	Defective cluster location information	—	(7)

Flag1
For replacement: 0
For defect: 1

Flag2
Replace in Spare area or no replacement cluster: 0
Replace in User data area: 1

Flag3
Single cluster : 00
Contiguous clusters (start location) : 01
Contiguous clusters (end location) : 10

FIG. 12

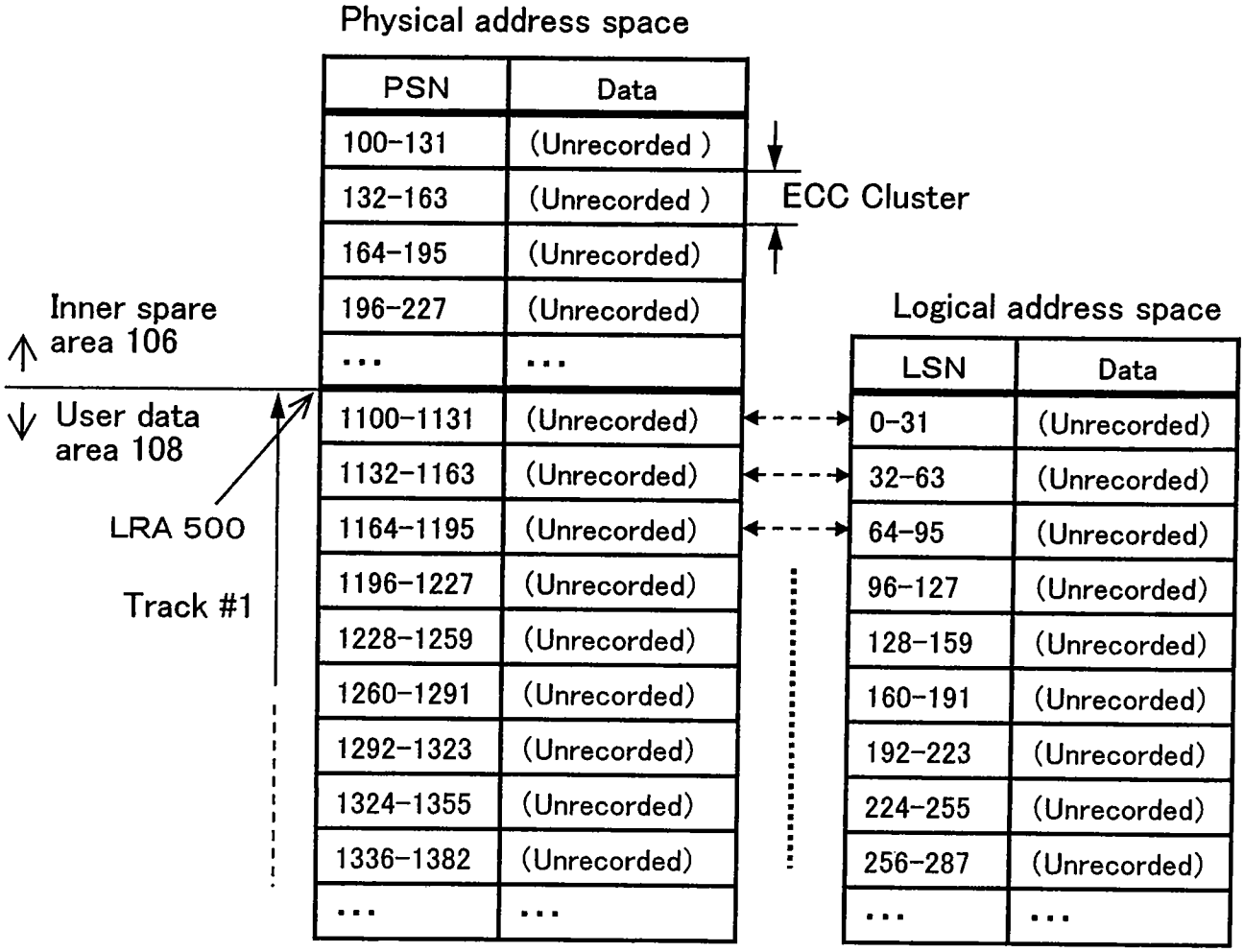

Physical address space
PSN
Data
100-131
(Unrecorded)
132-163
(Unrecorded)
164-195
(Unrecorded)
196-227
(Unrecorded)
ECC Cluster
Inner spare area 106
User data area 108
LRA 500
Track #1
1100-1131
(Unrecorded)
1132-1163
(Unrecorded)
1164-1195
(Unrecorded)
1196-1227
(Unrecorded)
1228-1259
(Unrecorded)
1260-1291
(Unrecorded)
1292-1323
(Unrecorded)
1324-1355
(Unrecorded)
1336-1382
(Unrecorded)
Logical address space
LSN
Data
0-31
(Unrecorded)
32-63
(Unrecorded)
64-95
(Unrecorded)
96-127
(Unrecorded)
128-159
(Unrecorded)
160-191
(Unrecorded)
192-223
(Unrecorded)
224-255
(Unrecorded)
256-287
(Unrecorded)

FIG. 13A

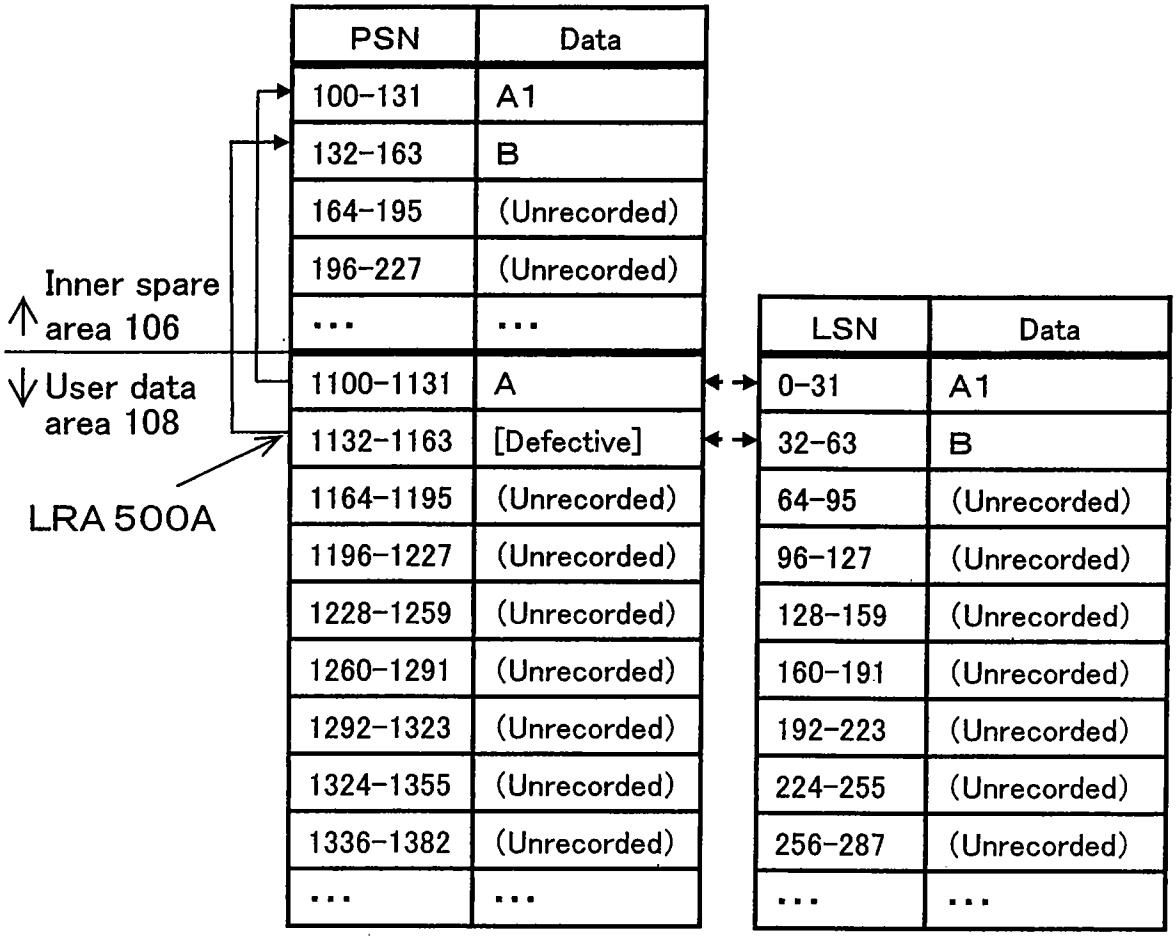


FIG. 13B

1000A

Status information			Original location	Replacement location
0	0	00	1100	100
0	0	00	1132	132

511

512

FIG. 14A

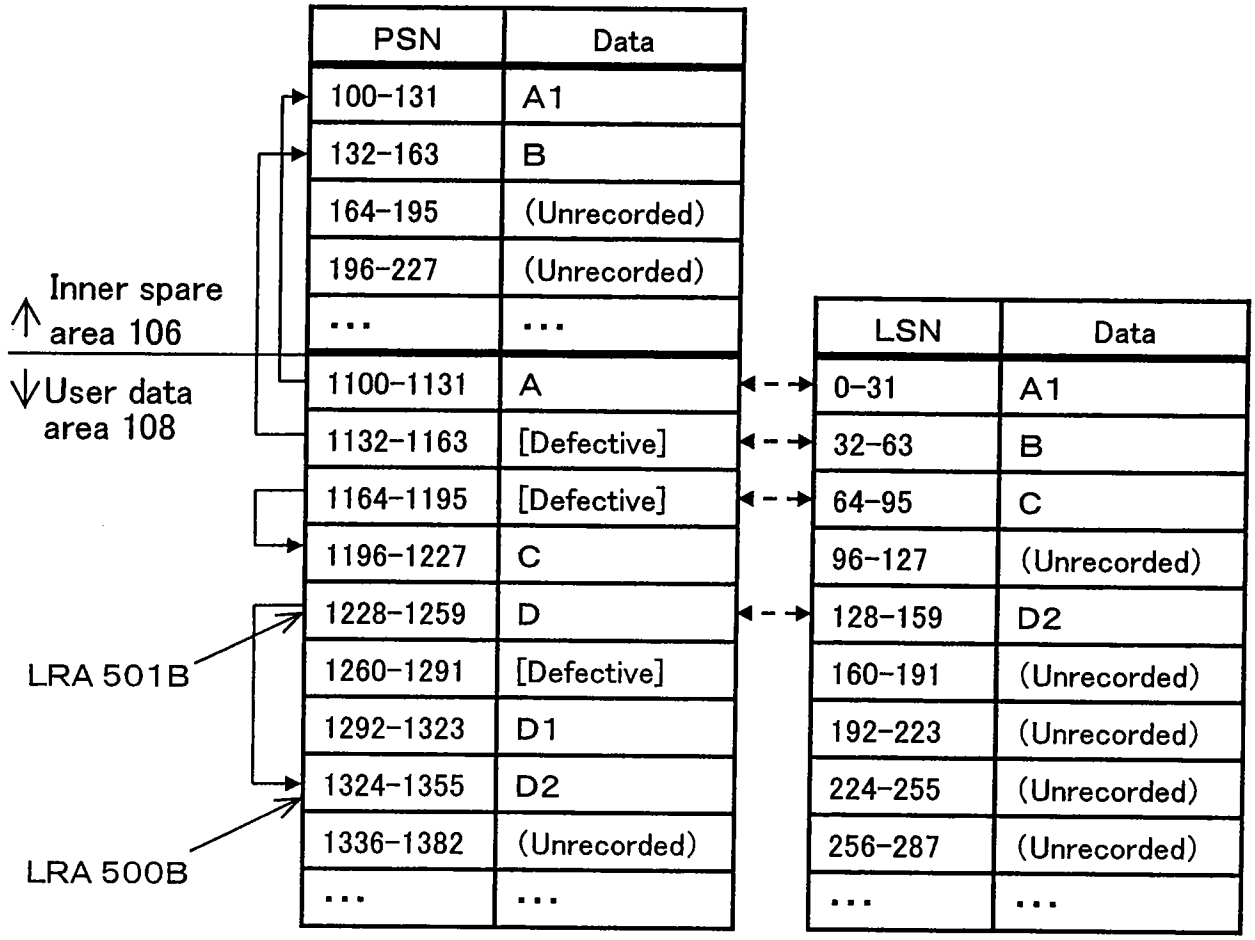


FIG. 14B

1000B

Status information			Original location	Replacement location
0	0	00	1100	100
0	0	00	1132	132
0	1	00	1164	1196
0	1	00	1228	1292
0	1	00	1228	1324
1	0	00	1260	0

511
512
513
514
514A
515

FIG. 15A

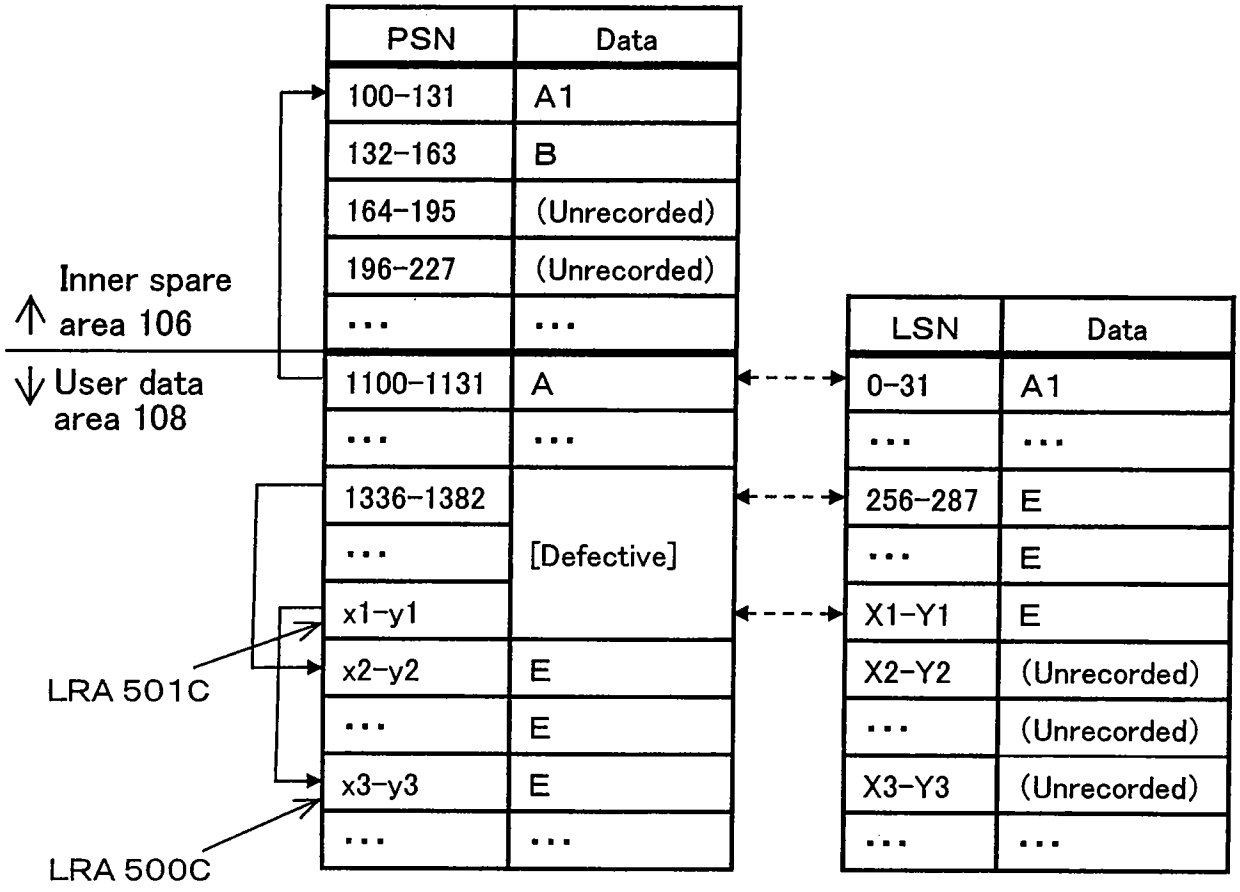


FIG. 15B

1000C

Status information			Original location	Replacement location	
0	0	00	1100	100	511
0	0	00	1132	132	512
0	1	00	1164	1196	513
0	1	00	1228	1324	514A
0	1	01	1336	x2	516
0	1	10	x1	x3	517
1	0	00	1260	0	515

FIG. 16A

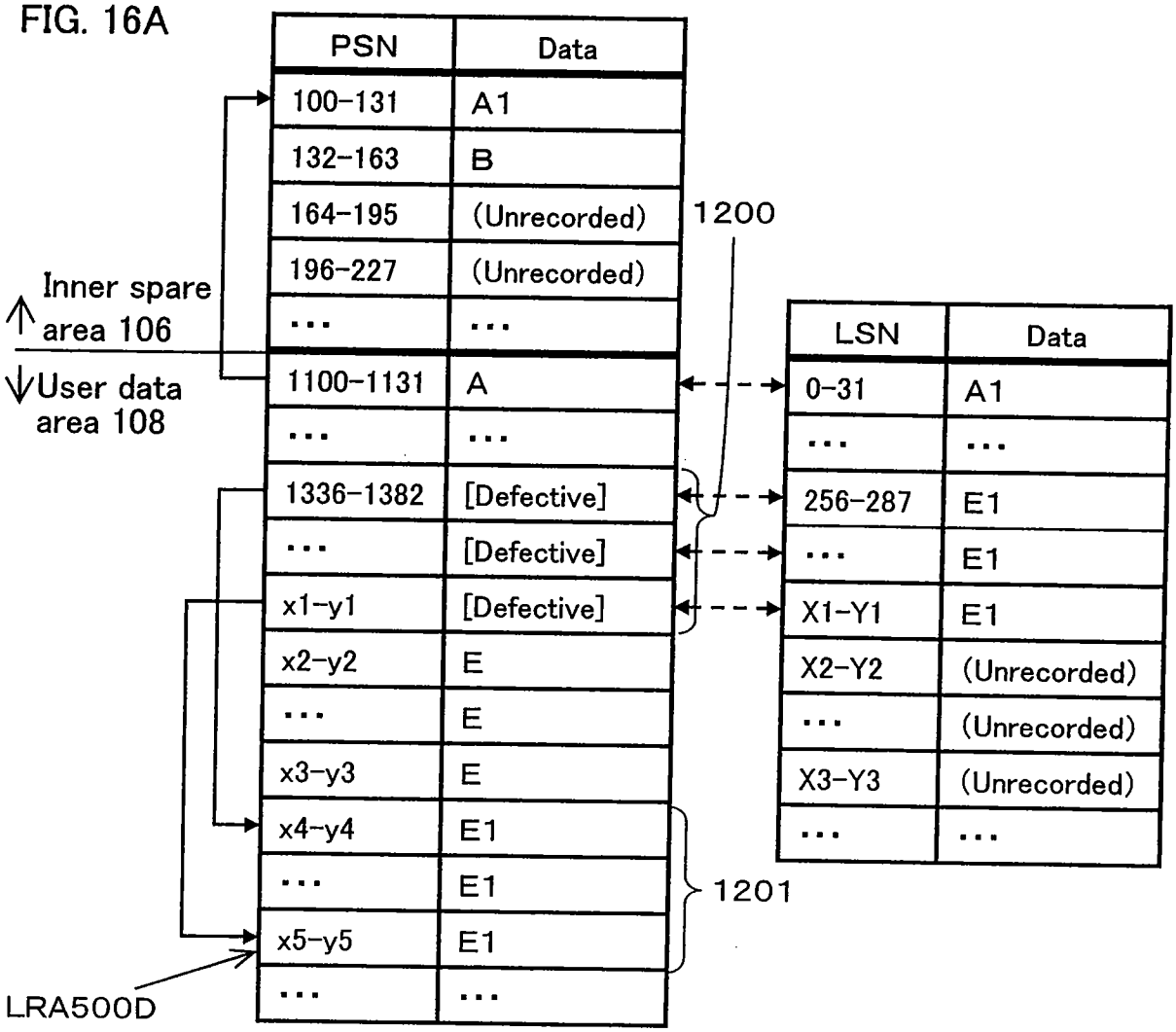


FIG. 16B

1000D

Status information			Original location	Replacement location
0	0	00	1100	100
0	0	00	1132	132
0	1	00	1164	1196
0	1	00	1228	1324
0	1	01	1336	x2
0	1	10	x1	x3
0	1	01	1336	x4
0	1	10	x1	x5
1	0	00	1260	0

511
512
513
514A
516
517
516A
517A
515

FIG. 17A

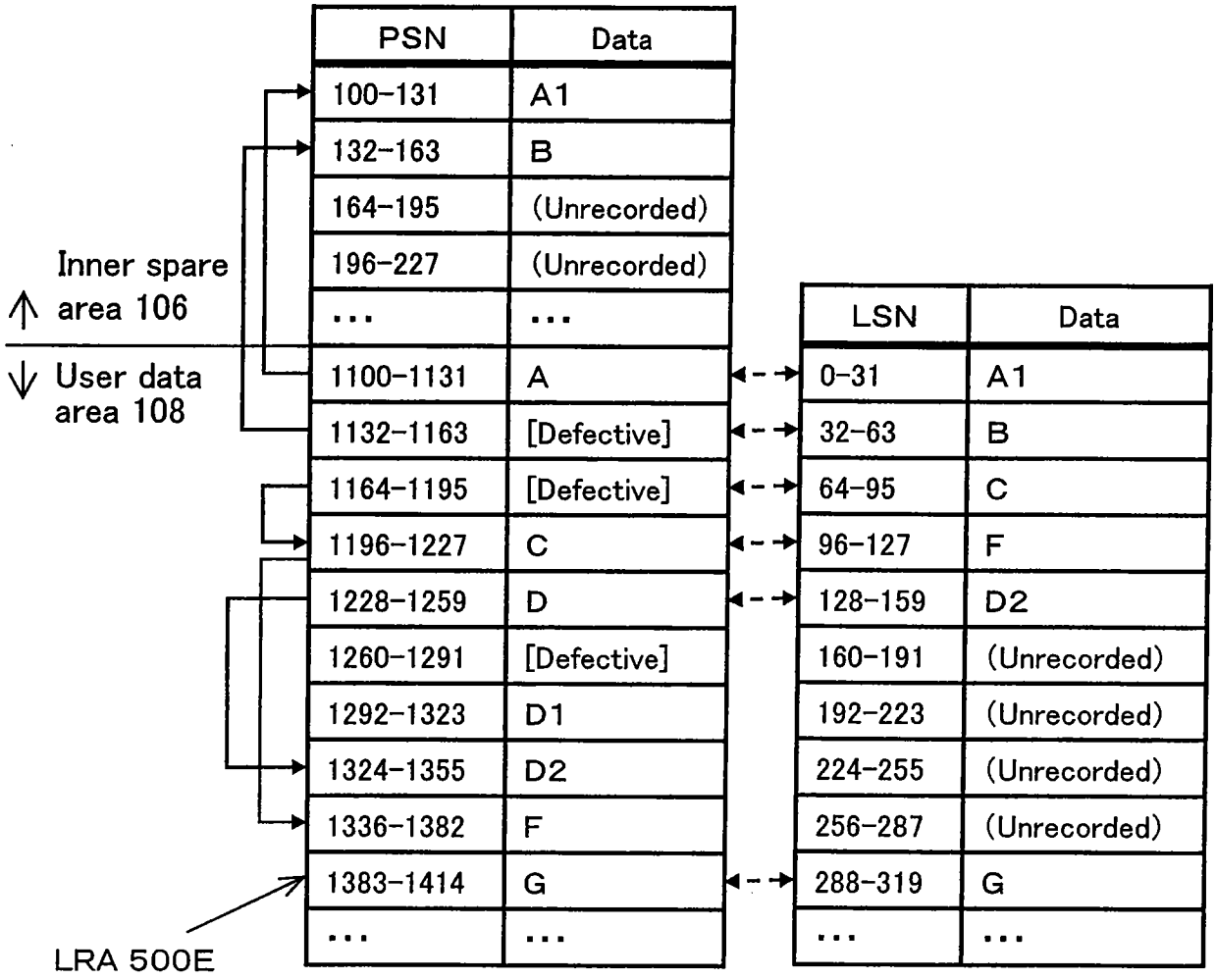


FIG. 17B

1000E

Status information			Original location	Replacement location	
0	0	00	1100	100	511
0	0	00	1132	132	512
0	1	00	1164	1196	513
0	1	00	1196	1336	518
0	1	00	1228	1324	514A
1	0	00	1260	0	515

FIG. 18

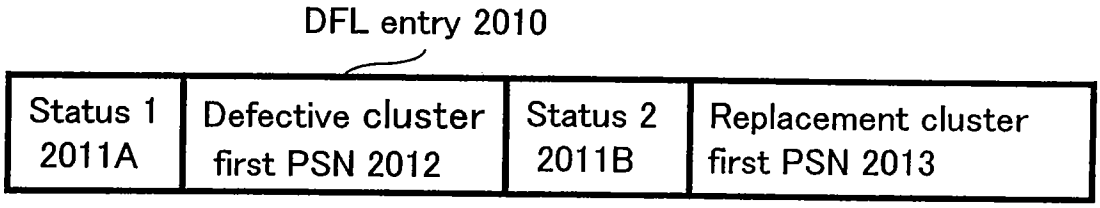

DFL entry 2010
Status 1
2011A
Defective cluster
first PSN 2012
Status 2
2011B
Replacement cluster
first PSN 2013

FIG. 19A

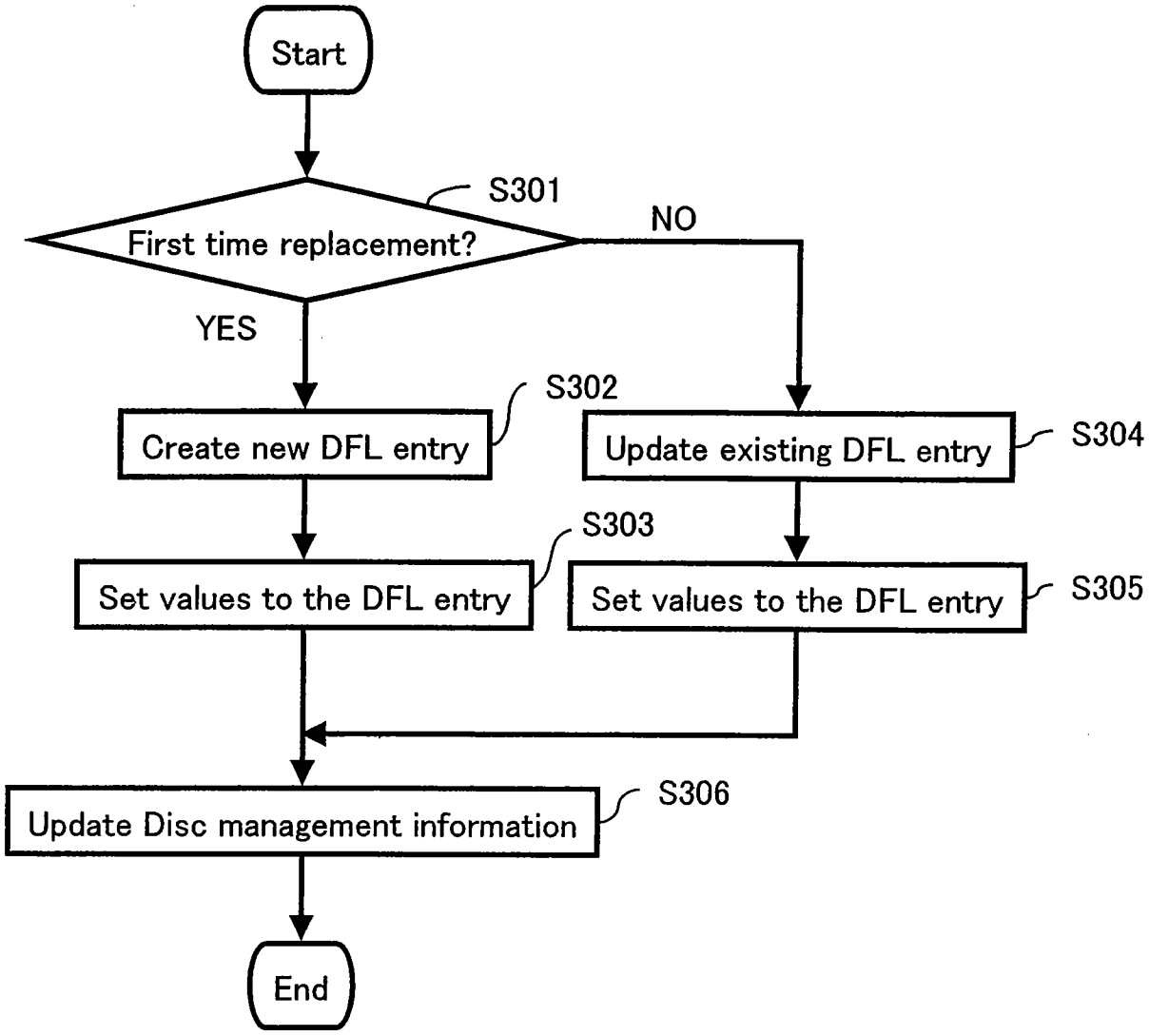

Start
S301
First time replacement?
NO
YES
S302
Create new DFL entry
Update existing DFL entry
S304
S303
Set values to the DFL entry
Set values to the DFL entry
S305
Update Disc management information
S306
End

FIG.19B

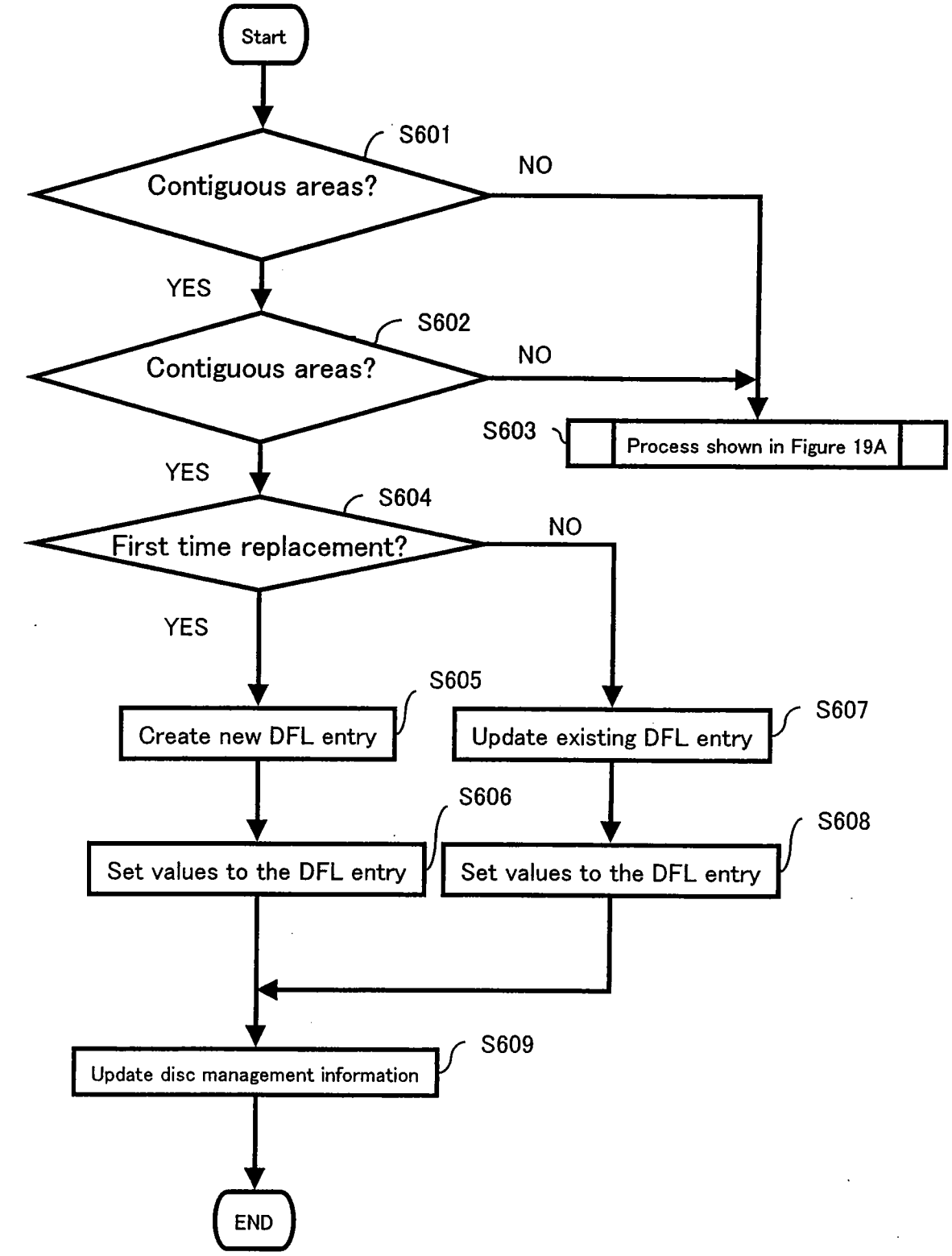

Start
S601
Contiguous areas?
NO
YES
S602
Contiguous areas?
NO
S603
Process shown in Figure 19A
YES
S604
First time replacement?
NO
YES
S605
Create new DFL entry
S607
Update existing DFL entry
S606
Set values to the DFL entry
S608
Set values to the DFL entry
S609
Update disc management information
END

FIG. 20A

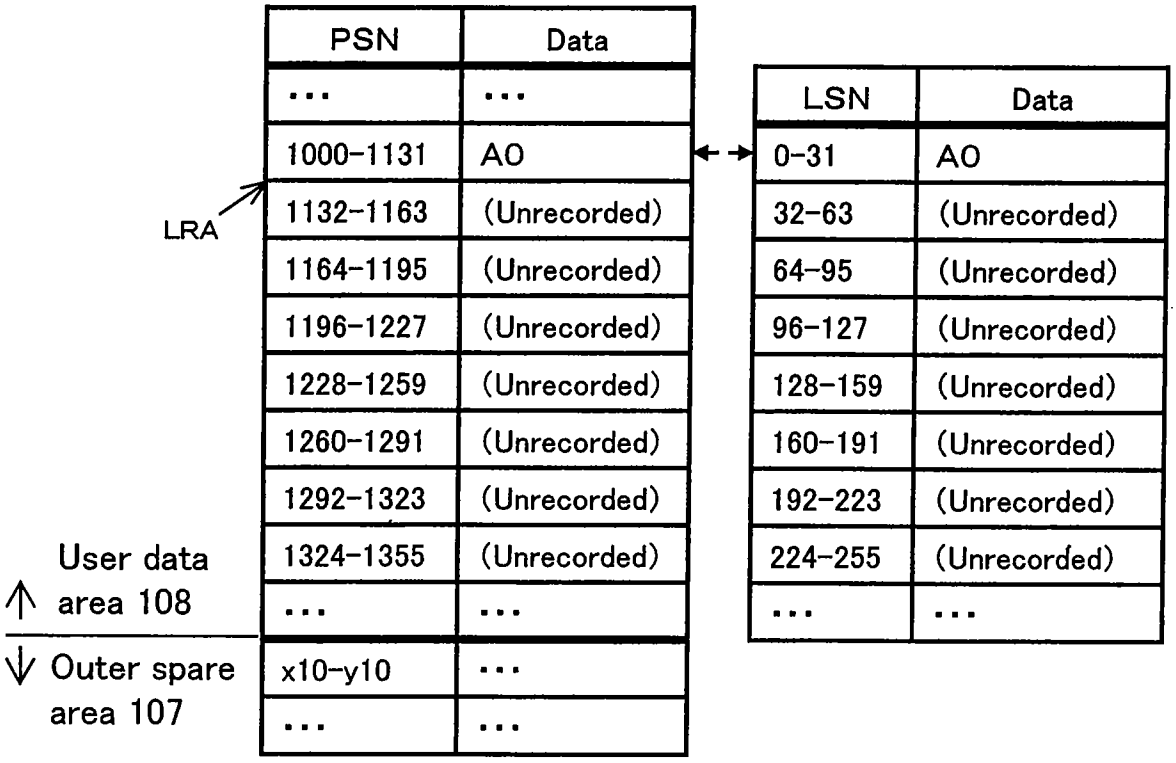
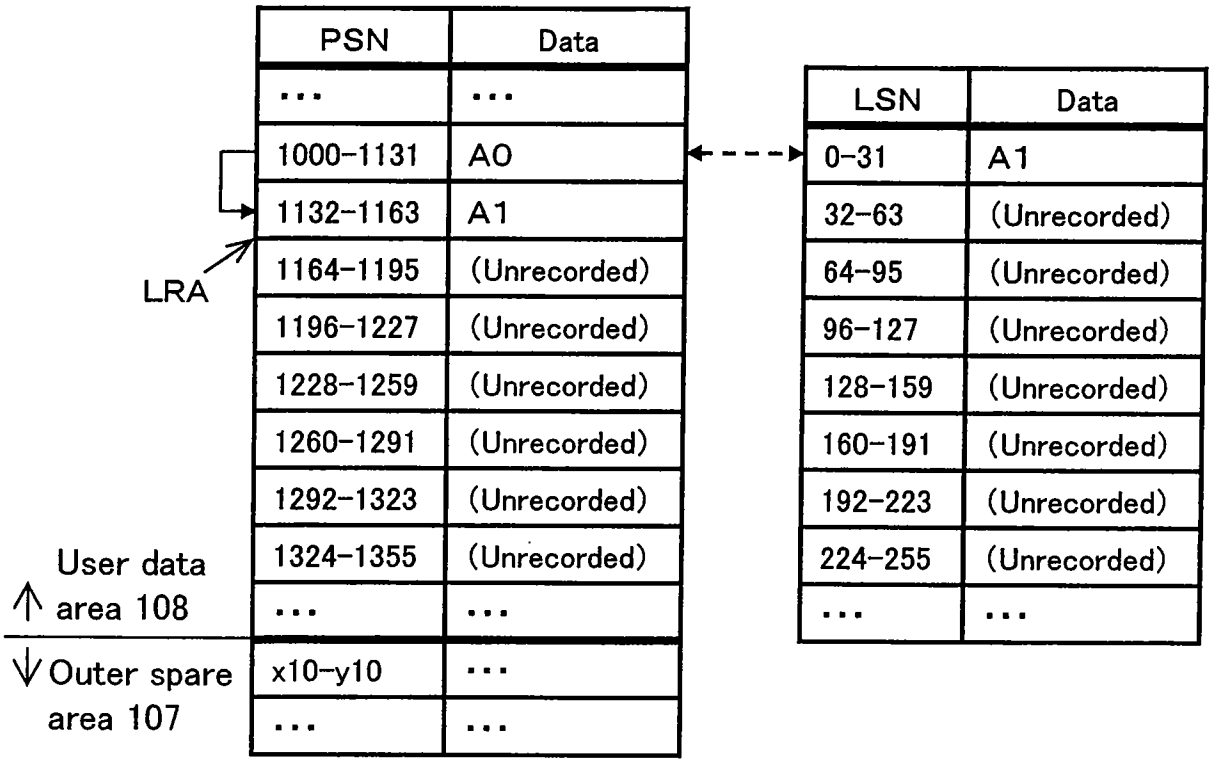


FIG. 20B

FIG. 21A



PSN	Data
...	...
1000-1131	AO
1132-1163	A1
1164-1195	(Unrecorded)
1196-1227	(Unrecorded)
1228-1259	(Unrecorded)
1260-1291	(Unrecorded)
1292-1323	(Unrecorded)
1324-1355	(Unrecorded)
...	...
x10-y10	...
...	...

LSN	Data
0-31	A1
32-63	(Unrecorded)
64-95	(Unrecorded)
96-127	(Unrecorded)
128-159	(Unrecorded)
160-191	(Unrecorded)
192-223	(Unrecorded)
224-255	(Unrecorded)
...	...

FIG. 21B

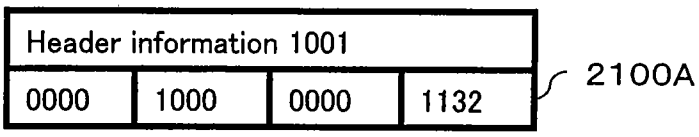


FIG. 22A

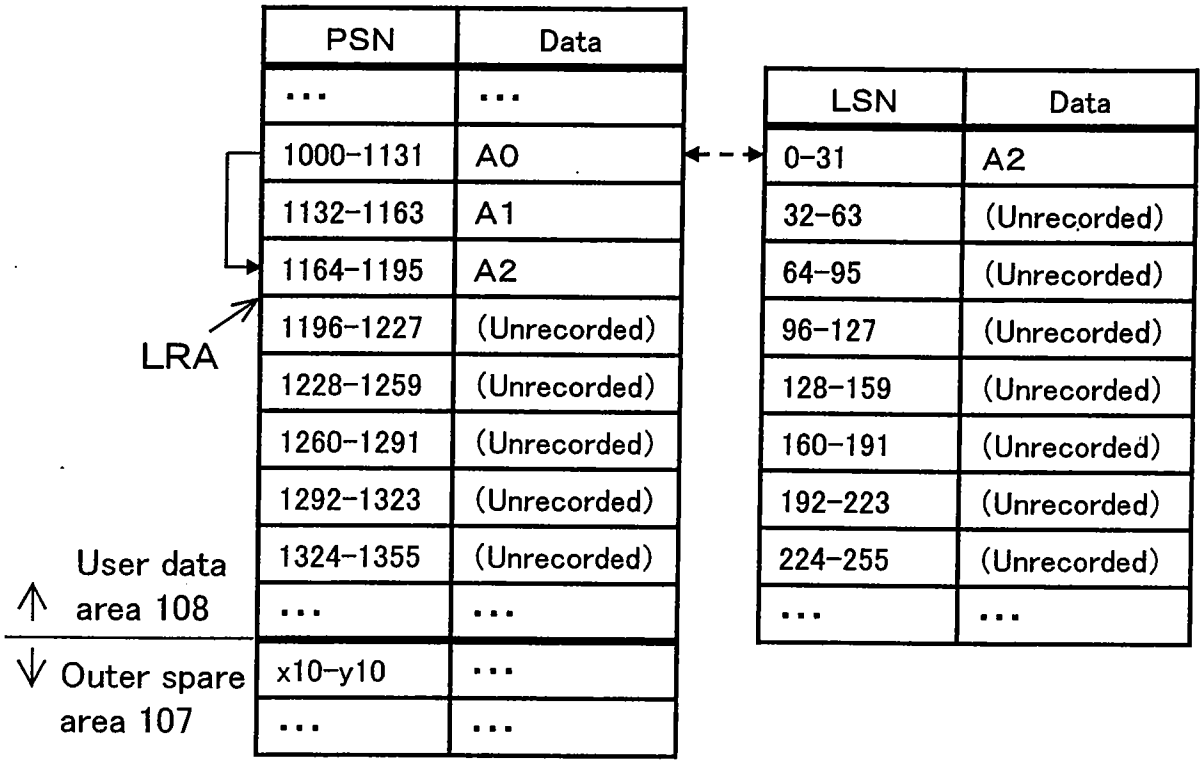


FIG. 22B

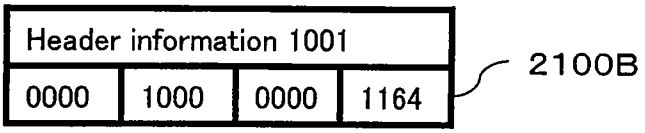


FIG. 23A

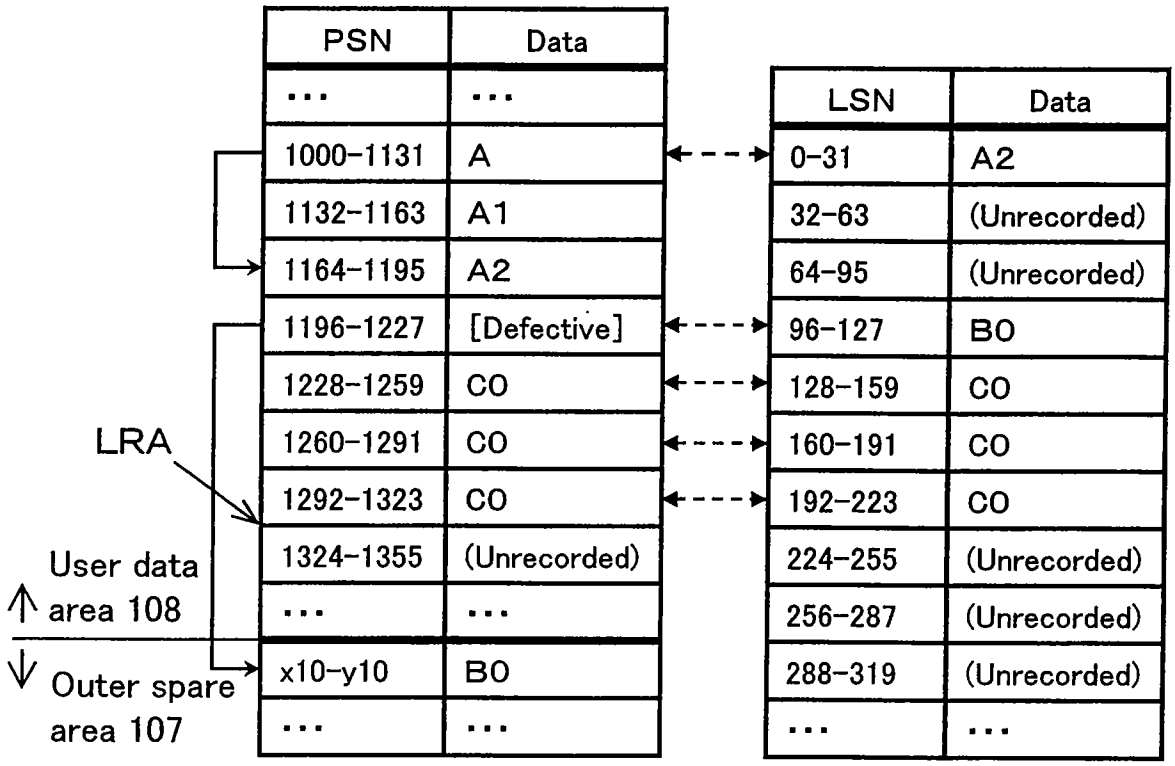


FIG. 23B

Header information 1001			
0000	1000	0000	1164
0000	1196	0000	x10

2100B
2101A

FIG. 24A

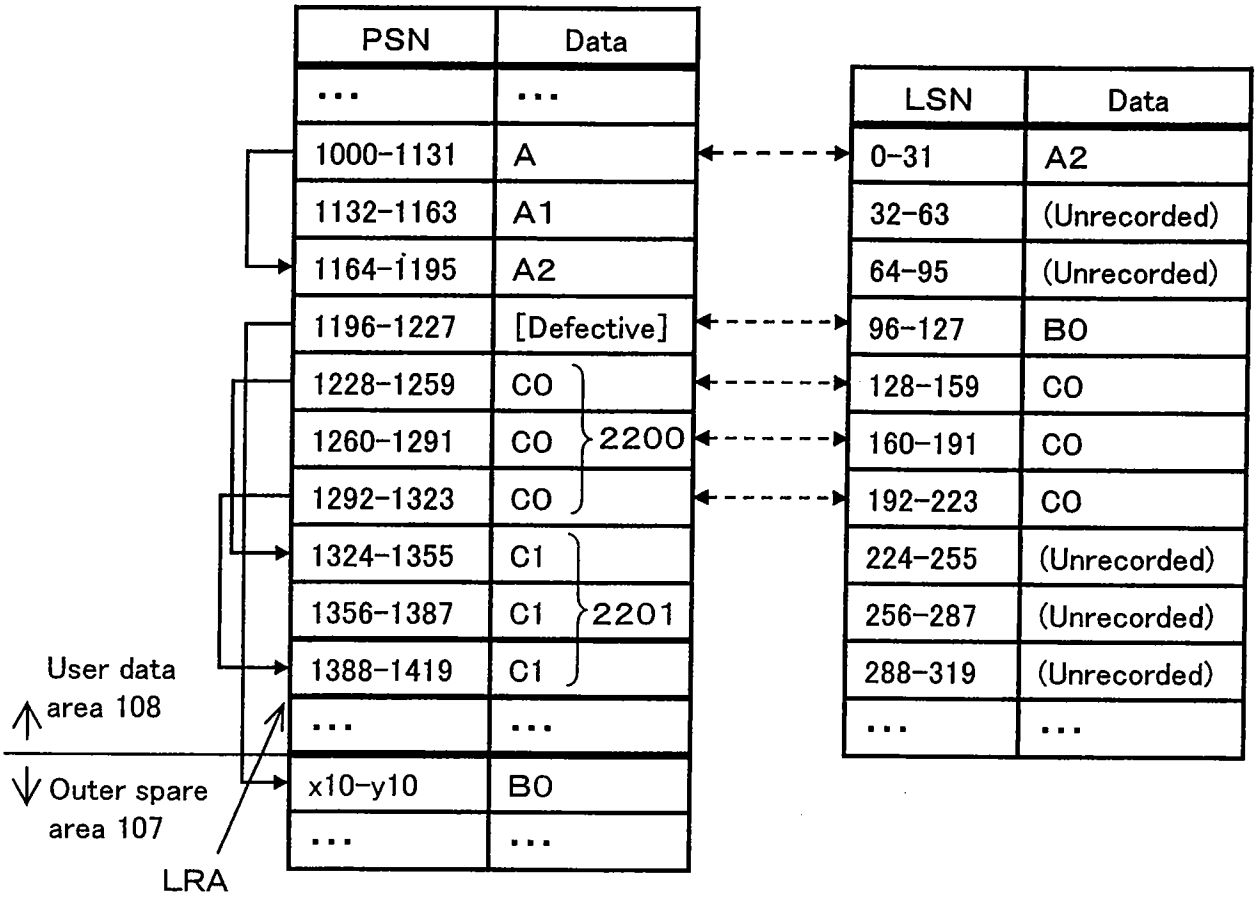


FIG. 24B

Header information 1001				
0000	1000	0000	1164	2100B
0000	1196	0000	x10	2101A
0000	1228	0001	1324	2102A
0000	1292	0010	1388	2103A

FIG. 25

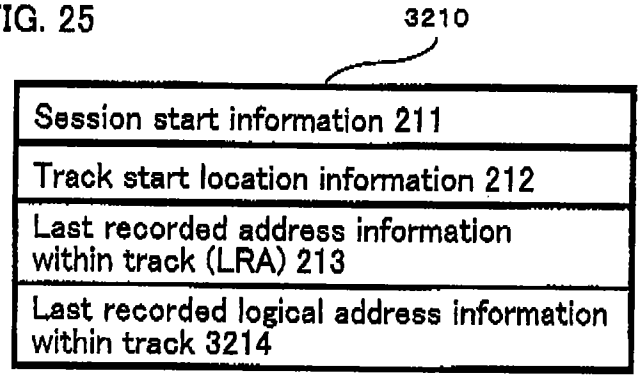

3210
Session start information 211
Track start location information 212
Last recorded address information within track (LRA) 213
Last recorded logical address information within track 3214

FIG. 26A

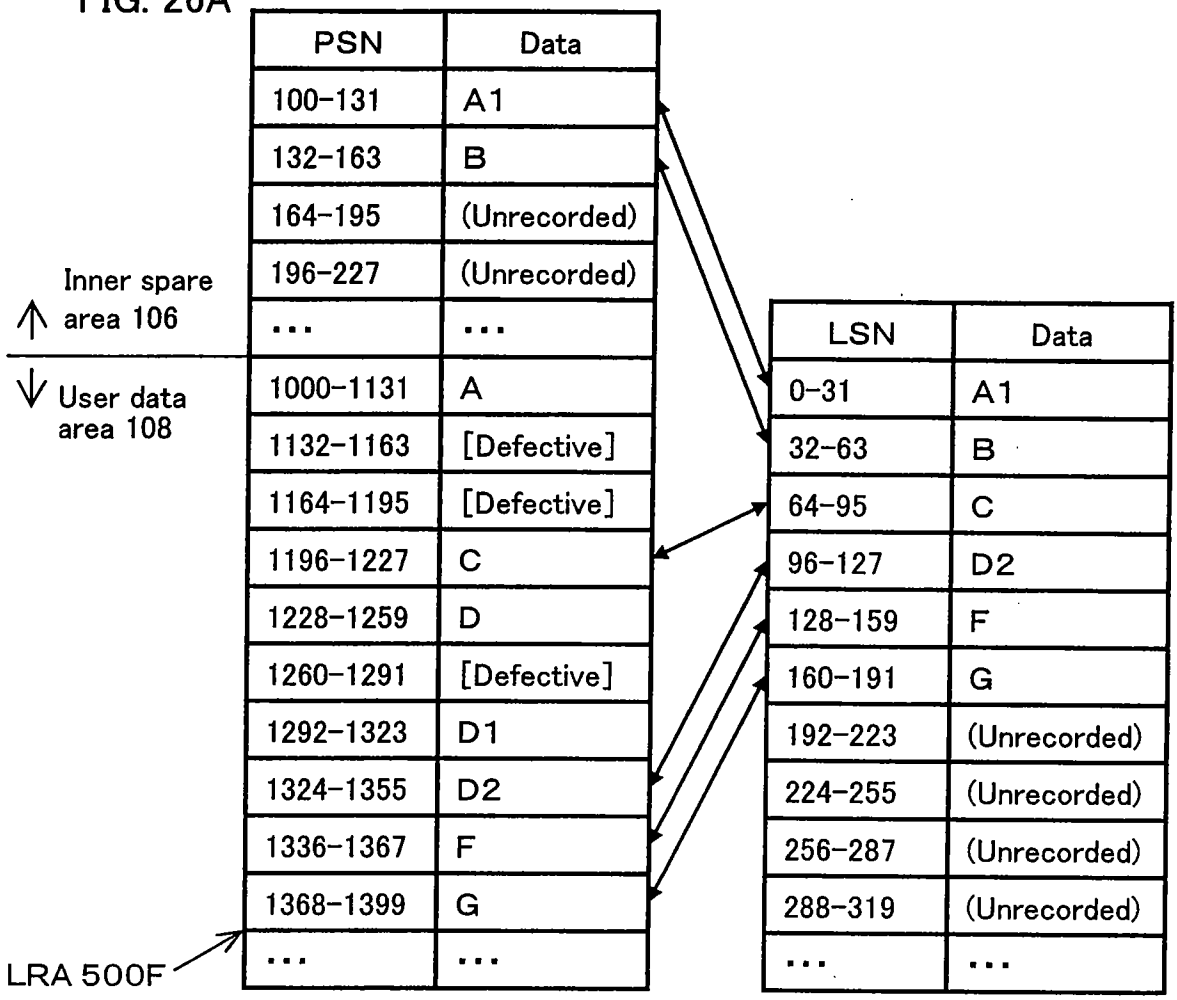


FIG. 26B

1000F

Status information			Original location	Replacement location
0	0	00	1000	100
0	0	00	1132	132
0	1	00	1164	1196
0	1	00	1196	1324
0	1	00	1228	1336
0	1	00	1260	1368
1	0	00	1132	0
1	0	00	1164	0
1	0	00	1260	0

521
522
523
524
525
526
530
531
532

FIG. 27

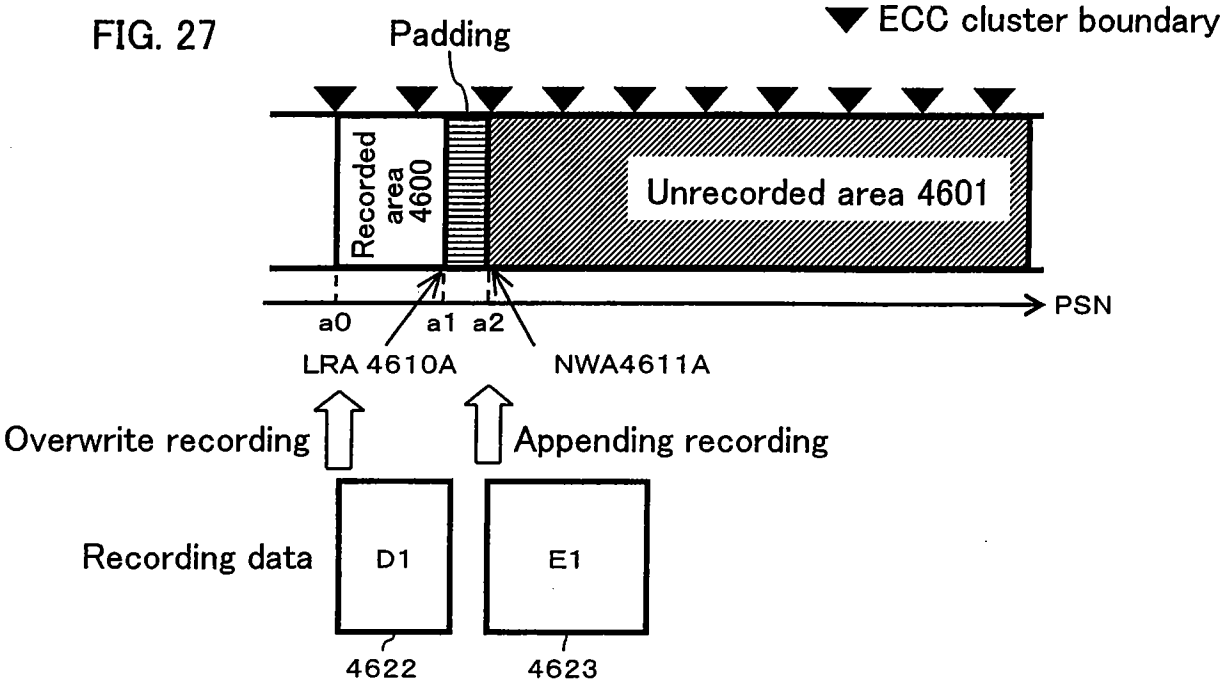


FIG. 28

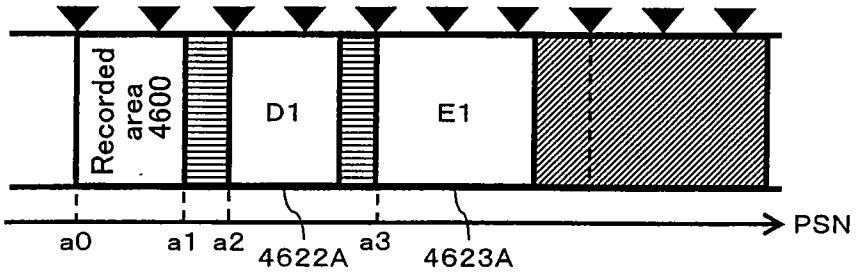


FIG. 29

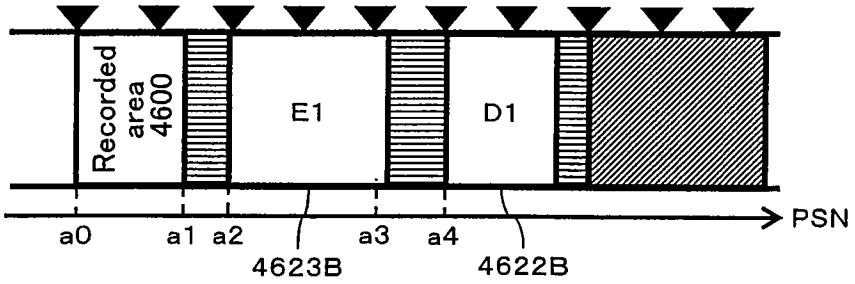


FIG. 30

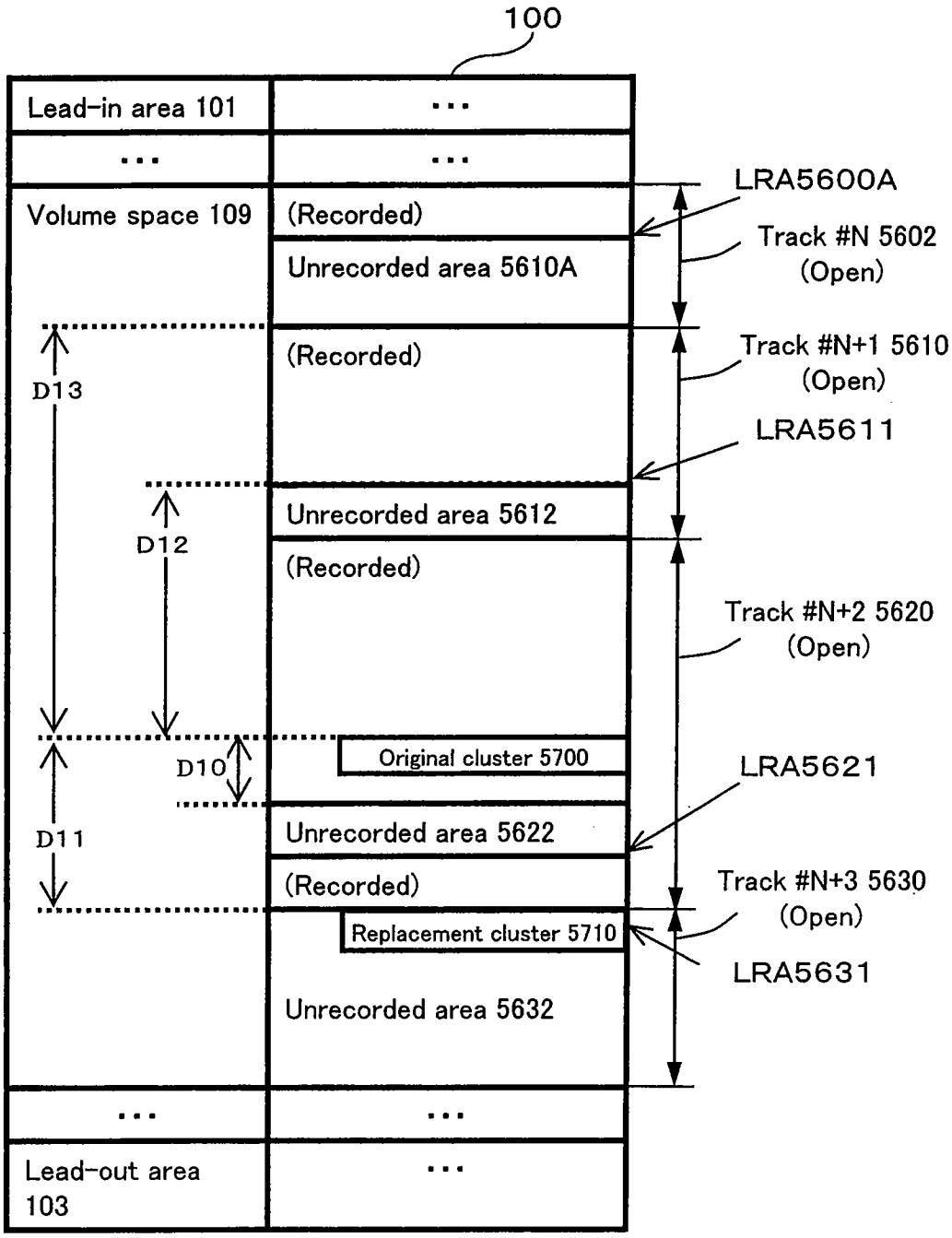

100
Lead-in area 101
Volume space 109
Lead-out area 103
(Recorded)
Unrecorded area 5610A
(Recorded)
Unrecorded area 5612
(Recorded)
Original cluster 5700
Unrecorded area 5622
(Recorded)
Replacement cluster 5710
Unrecorded area 5632
D13
D12
D10
D11
LRA5600A
Track #N 5602
(Open)
Track #N+1 5610
(Open)
LRA5611
Track #N+2 5620
(Open)
LRA5621
Track #N+3 5630
(Open)
LRA5631

FIG. 31

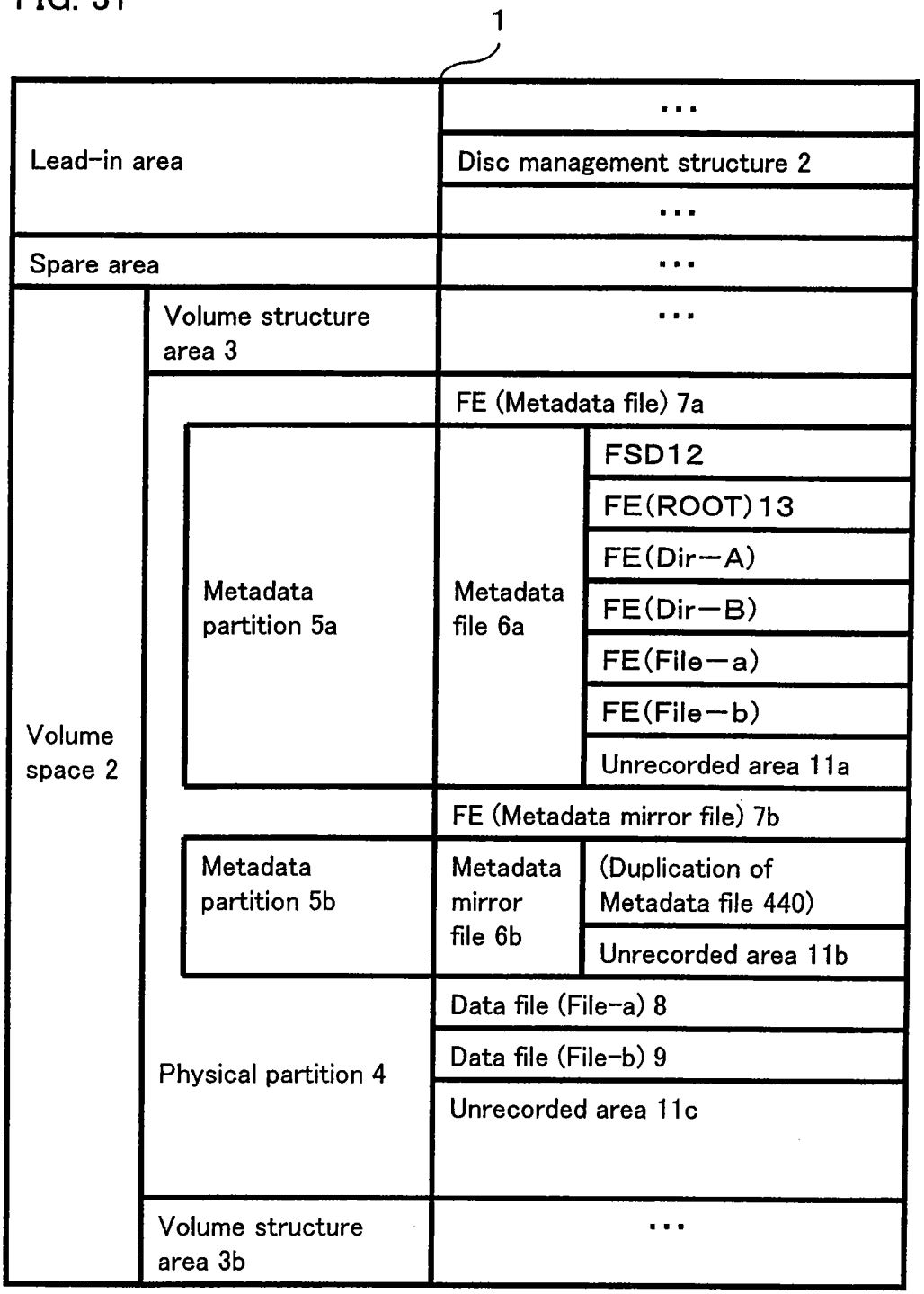

1
Lead-in area
Spare area
Volume space 2
Volume structure area 3
Metadata partition 5a
Metadata partition 5b
Physical partition 4
Volume structure area 3b
...
Disc management structure 2
...
...
...
FE (Metadata file) 7a
Metadata file 6a
FSD12
FE(ROOT) 13
FE(Dir—A)
FE(Dir—B)
FE(File—a)
FE(File—b)
Unrecorded area 11a
FE (Metadata mirror file) 7b
Metadata mirror file 6b
(Duplication of Metadata file 440)
Unrecorded area 11b
Data file (File-a) 8
Data file (File-b) 9
Unrecorded area 11c
...

FIG. 32

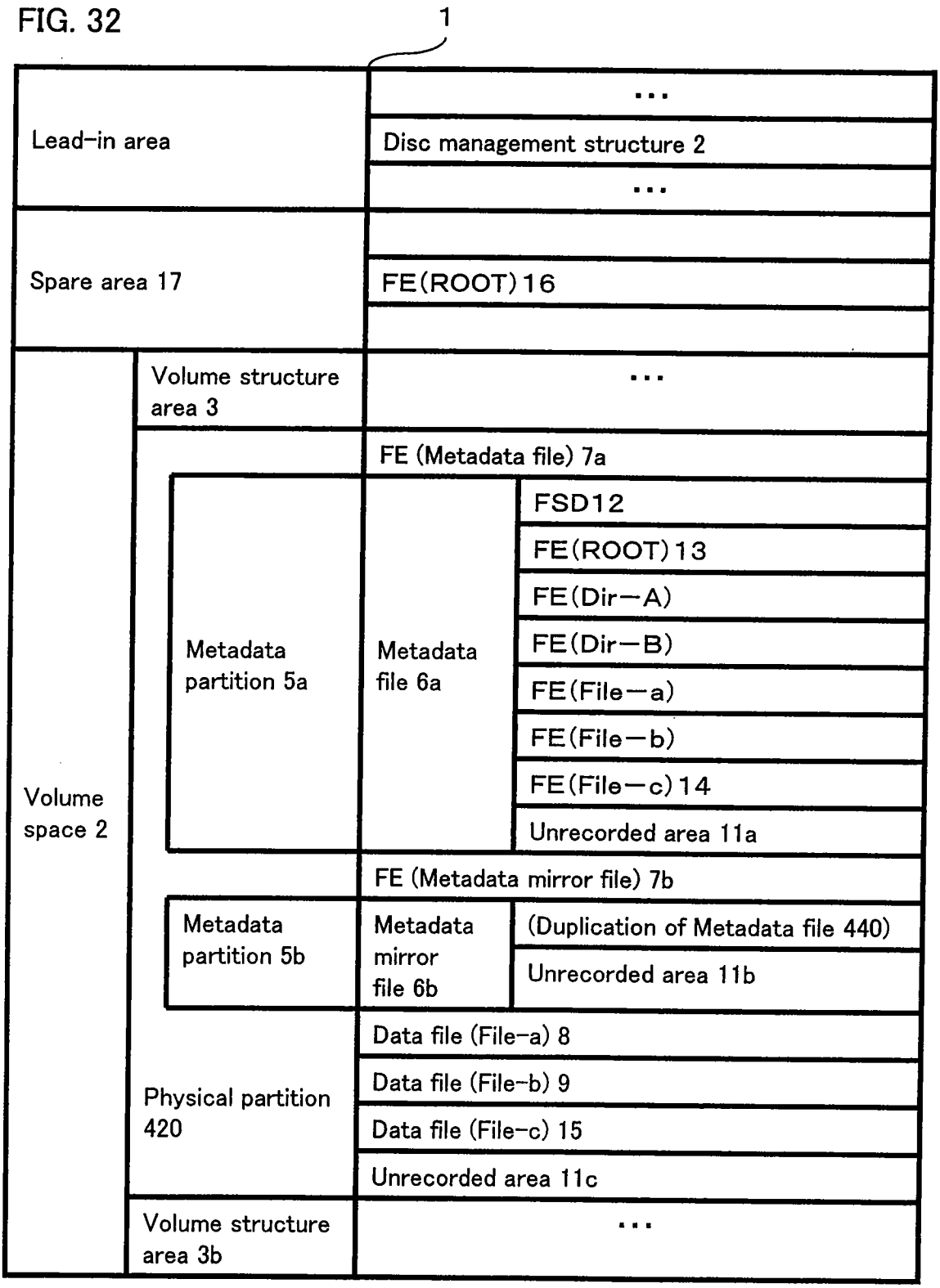

1
Lead-in area
Spare area 17
Volume space 2
Volume structure area 3
Metadata partition 5a
Metadata partition 5b
Physical partition 420
Volume structure area 3b
...
Disc management structure 2
FE(ROOT)16
FE (Metadata file) 7a
Metadata file 6a
FSD12
FE(ROOT)13
FE(Dir−A)
FE(Dir−B)
FE(File−a)
FE(File−b)
FE(File−c)14
Unrecorded area 11a
FE (Metadata mirror file) 7b
Metadata mirror file 6b
(Duplication of Metadata file 440)
Unrecorded area 11b
Data file (File-a) 8
Data file (File-b) 9
Data file (File-c) 15
Unrecorded area 11c

FIG. 33A

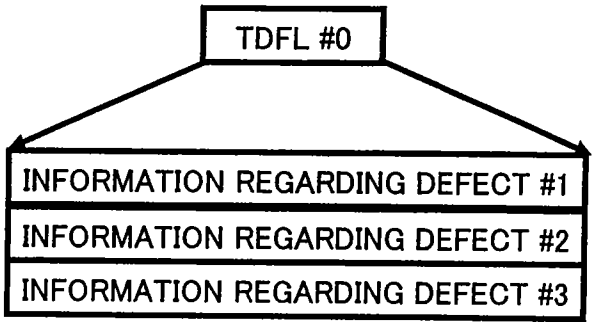


FIG. 33B

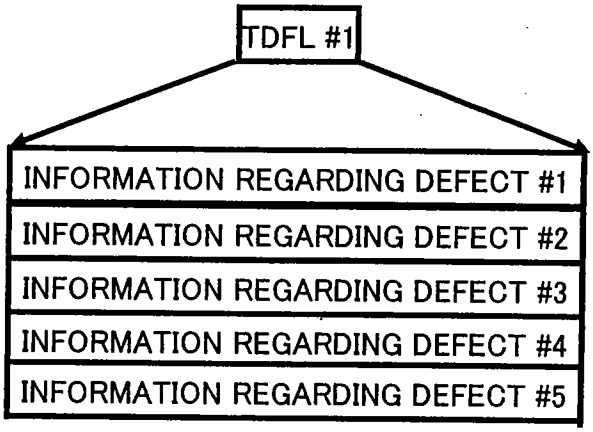


FIG.34

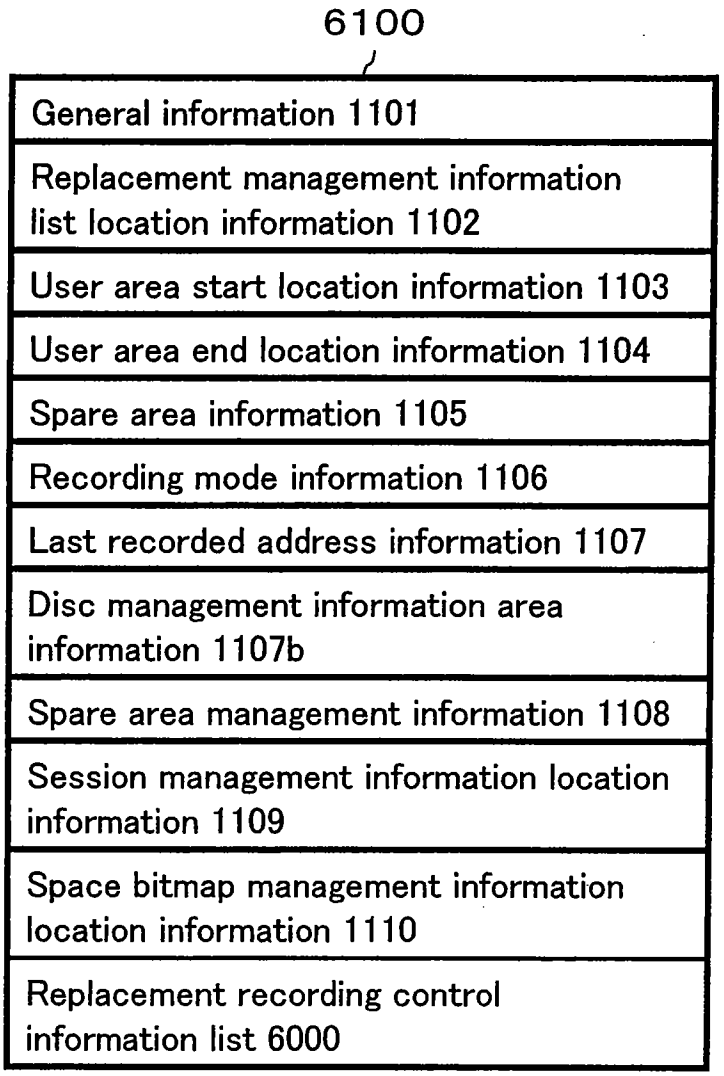

6100
General information 1101
Replacement management information list location information 1102
User area start location information 1103
User area end location information 1104
Spare area information 1105
Recording mode information 1106
Last recorded address information 1107
Disc management information area information 1107b
Spare area management information 1108
Session management information location information 1109
Space bitmap management information location information 1110
Replacement recording control information list 6000

FIG.35A

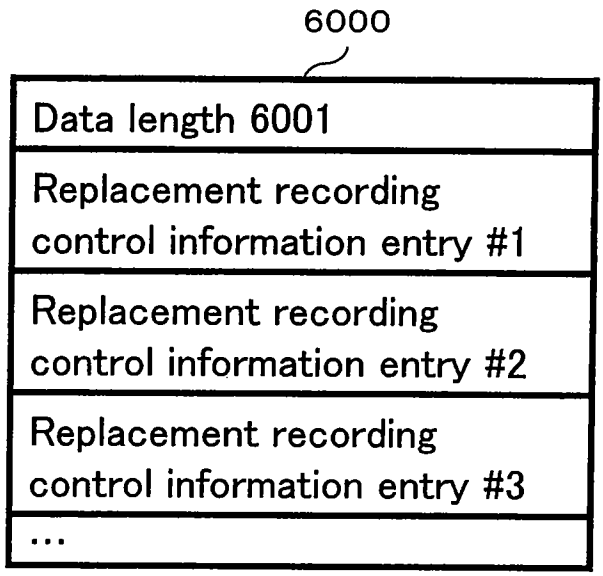


FIG.35B

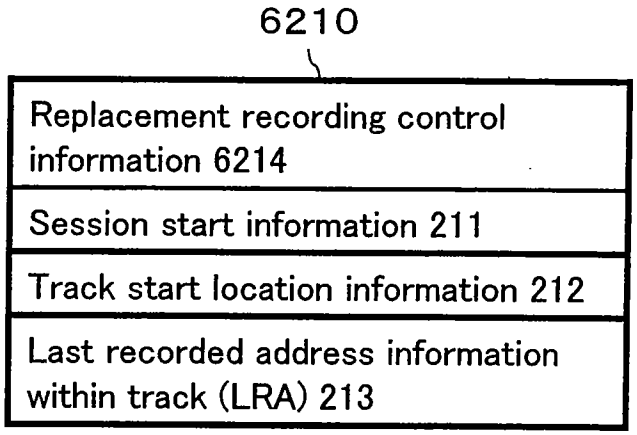


FIG.36A

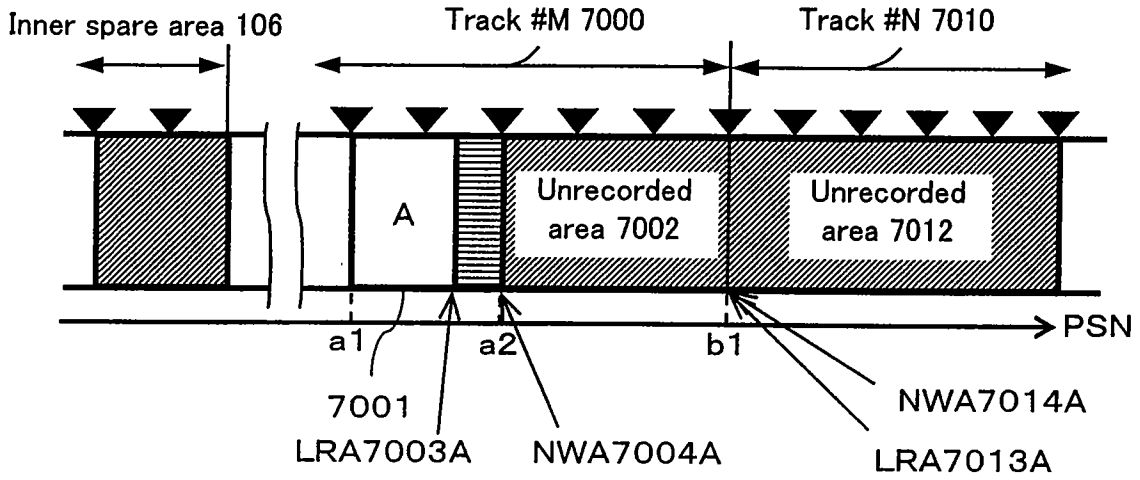


FIG.37A

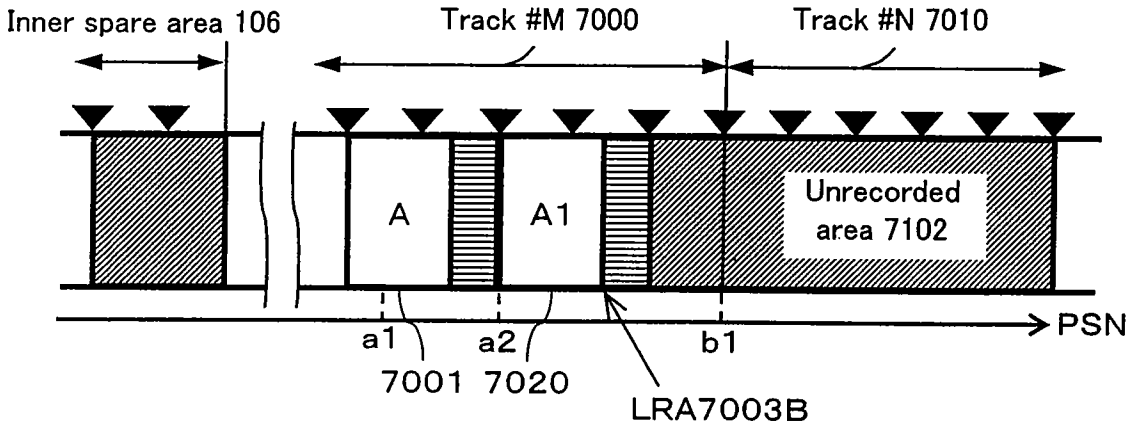


FIG.37B

Status information			Original location	Replacement location	
...					
0	1	00	a1	a2	7030
0	1	00	a2	0	7031
...					

FIG.38A

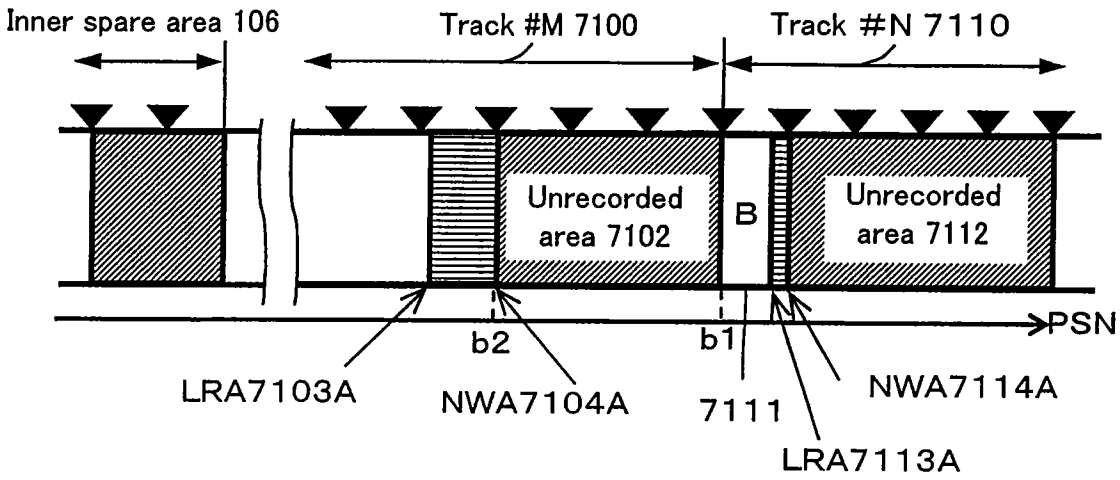


FIG.39A

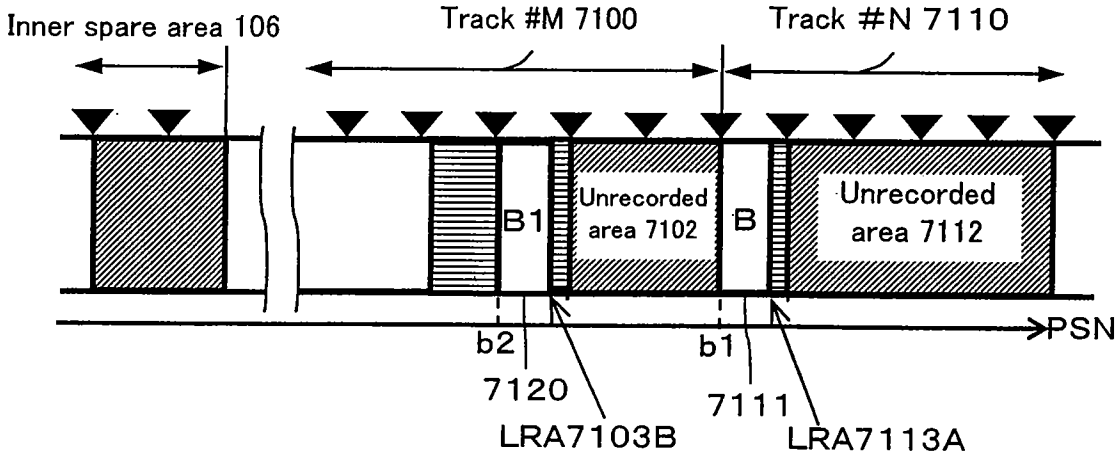


FIG.39B

Status information			Original location	Replacement location	
...					
0	1	00	b2	0	7131
0	1	00	b1	b2	7130
...					

FIG.40

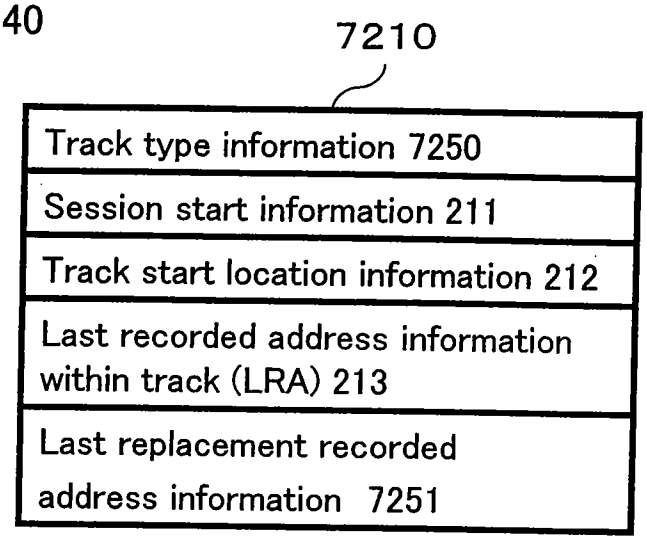

7210
Track type information 7250
Session start information 211
Track start location information 212
Last recorded address information within track (LRA) 213
Last replacement recorded address information 7251

FIG.41A

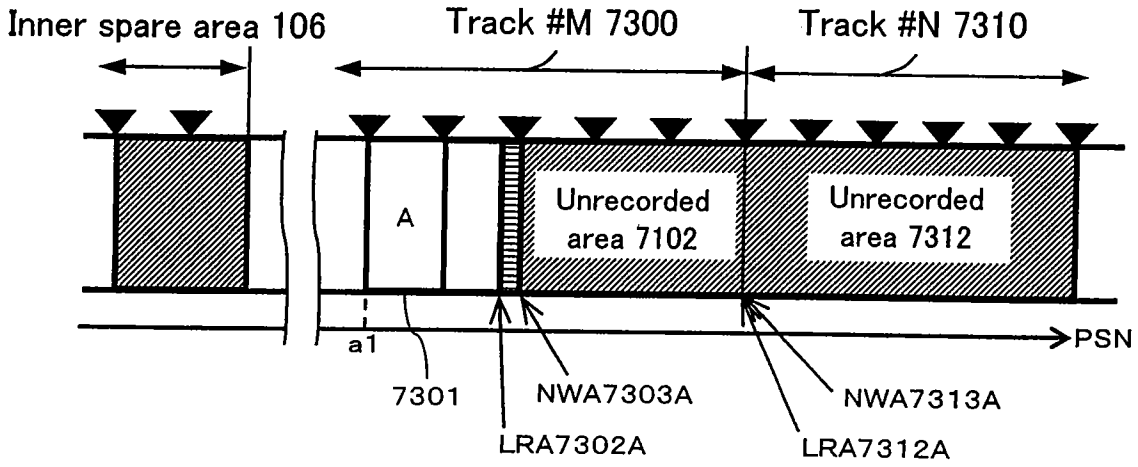


FIG.42A

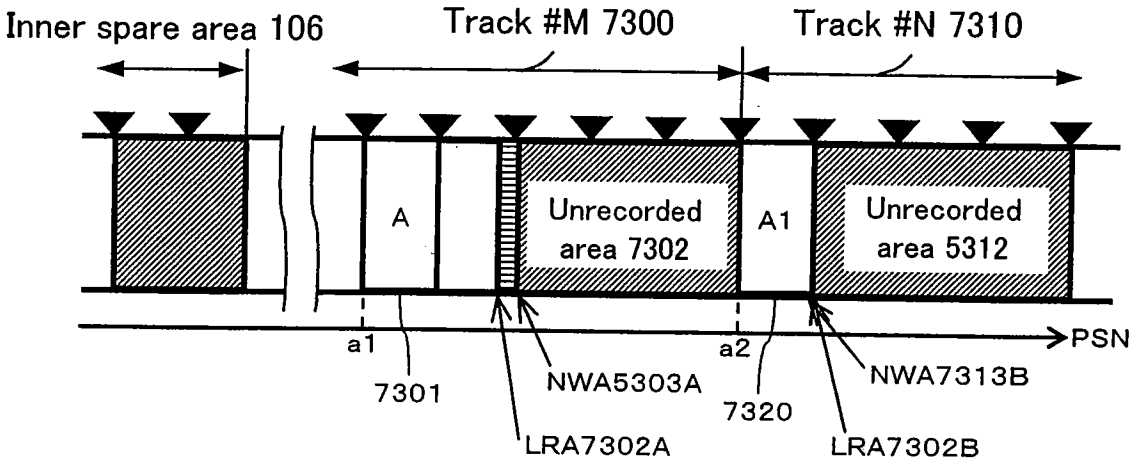


FIG.42B

Status information			Original location	Replacement location
0	0	00	a1	a2

7330

FIG.43

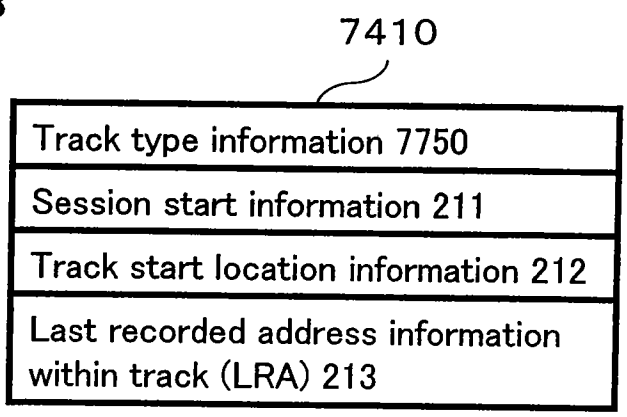
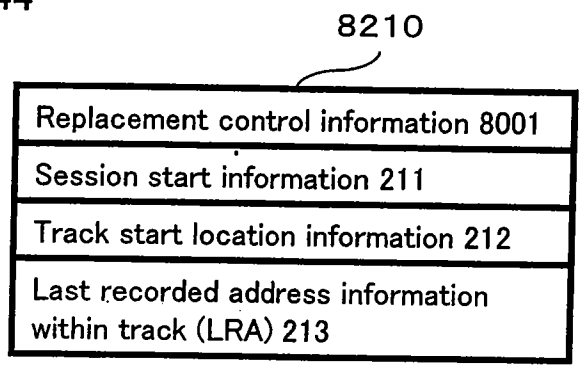

7410
Track type information 7750
Session start information 211
Track start location information 212
Last recorded address information within track (LRA) 213

FIG.44


8210
Replacement control information 8001
Session start information 211
Track start location information 212
Last recorded address information within track (LRA) 213